FREE DISC

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NVIDIA GEFORCE GTX 960

It's affordable and overclockable: is this the 'sweet spot' GPU you've been waiting for?

a+pc

YOUR EXPERT GUIDE TO TODAY'S TECH

March 2015
Issue 413

ANGE IS IN THE AIR

THE NEW PC!

CHROMECAST UNLOCKED

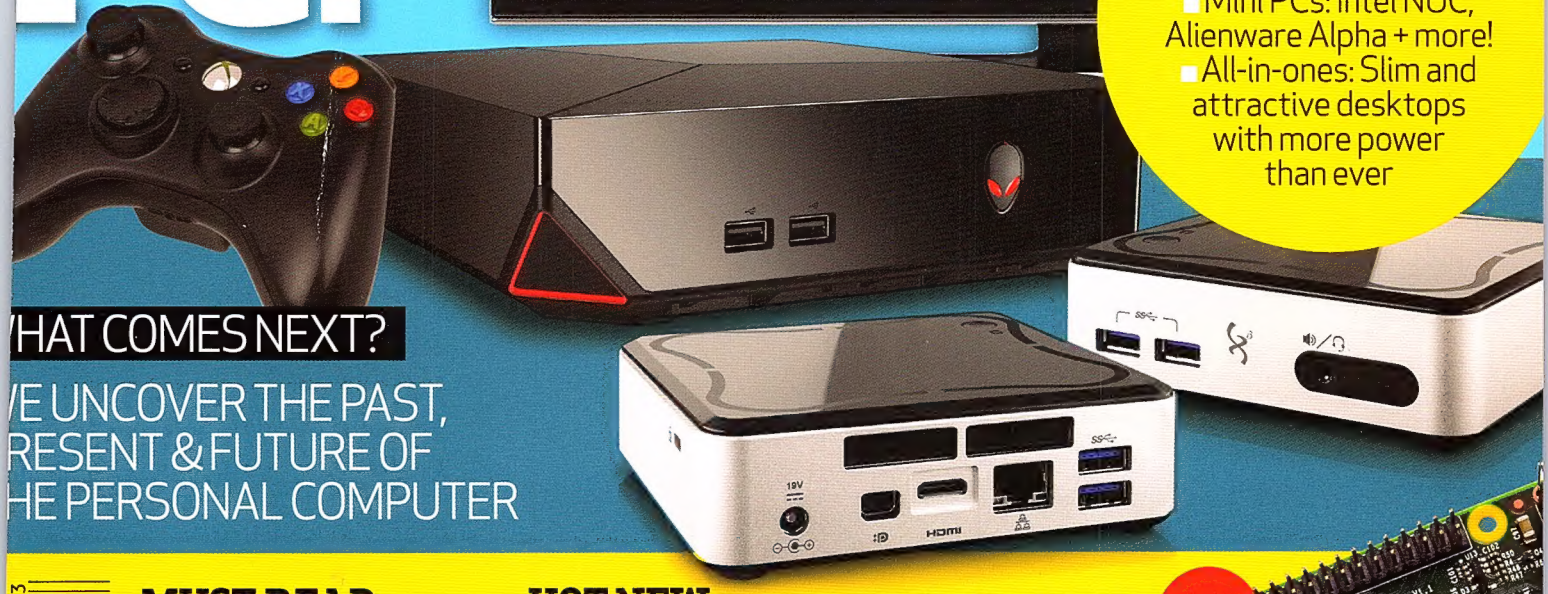
How to stream *any* content from *anywhere* to your Chromecast dongle!

$330 LAPTOP!

Is Kogan's budget notebook awesome or abominable?

LABS TESTED

- Mini PCs: Intel NUC, Alienware Alpha + more!
- All-in-ones: Slim and attractive desktops with more power than ever



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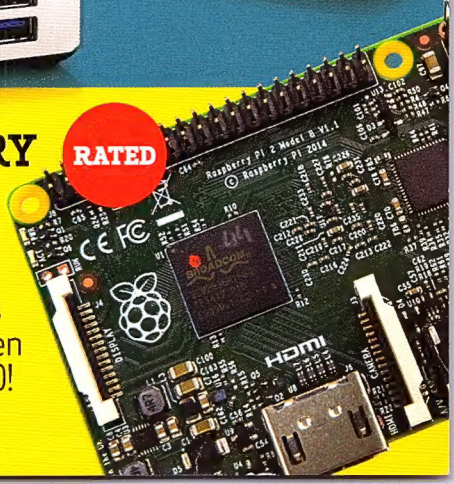
- Build a video-editing PC
- Recover lost Linux files
- Make your *own* Internet of Things!

HOT NEW PCs & TECH

- An Aussie-made network backup box
- HP goes gaming with its new Omen laptop
- Best new apps for PC, Mac, Android & iOS

RASPBERRY PI 2: FULL REVIEW!

The $45 palm-sized PC grows up – and it'll even run Windows 10!



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Future

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FIPP

Can the PC make a comeback?

And more importantly, does it really need to? APC's editor investigates...

A couple of years ago, on the back of booming sales of tablet PCs like the iPad, many pundits were saying the PC was dead. In 2015, that may have turned 180°, with some analysts predicting a rebound for PCs and laptops, pointing to a slide in tablet sales last year as an indication that consumers are tired of the devices – and that they're ready for a return to 'real' computers. (Is the tablet the new netbook? I don't quite think so, but to most people, I'd guess they're far less essential than having a good PC or laptop and a smartphone.)

And PC makers are trying all kinds of tactics and designs to stir up public interest – we've looked at mini-PCs like the Intel NUC this month, alongside all-in-ones that make the desktop PC a little more attractive. But the PC market is far more varied in 2015 than its been in its entire history. With Steam Machines due this year (hey, we've already seen one, so there's a chance more will arrive), low-cost Chromebooks and Chromeboxes pushing down laptop and PC prices to new lows (and forcing Microsoft to follow suit – see our review of the $329 Kogan Windows 8 laptop for proof) and devices like the Raspberry Pi and Arduino helping to get kids (and some brainy adults!) interested in programming and general DIY gadgeteering, there's a huge number of options – for both the general consumer and the PC enthusiast.

And speaking of enthusiasm, PC gaming is one area that continues to buck the general downward trend. There's a reason every motherboard and graphics card maker now has specifically 'Gaming' branded product lines: PC gamers are often the serial upgraders, those who'll consider rebuilding their rig every year or two – or at least throwing in a new graphics card and grabbing a new monitor.

The PC, then, doesn't really need to make a comeback, because it's never really gone away. In fact, it's still everywhere you look. While our desktops and laptops may not be our *only* windows into the digital world these days, they still fill a large and critical role... and most of us would be more than a little lost without them. ■

DAN GARDINER
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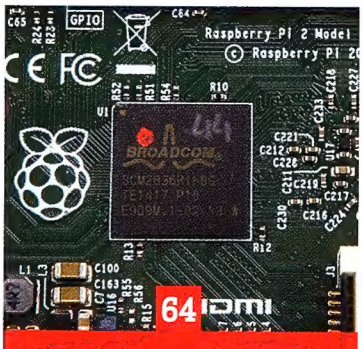

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Is AI a threat to humanity?

Many experts seem to think so...

We've all been raised on film, literature and pop culture that believes that we as a human race are foolishly working towards the creation of sentient machines that will enslave us all. But how likely is this? Is it actually possible that an artificial intelligence could become self-aware and decide for itself that it needs to eradicate us in order to save the world?

While this might sound like ridiculous science fiction material, AI experts from around the world have genuine concerns about situations like this, signing an open letter issued by the Future of Life Institute that aims to ensure that the field does not grow beyond the control of humanity.

The Institute, which is made up solely of volunteers, is an organisation founded by many of the world's leading computer science experts and mathematicians, including MIT professor Max Tegmark and Skype co-founder Jaan Tallinn.

High-profile signatories of the open letter include Tesla Motors CEO Elon Musk and theoretical physicist Stephen Hawking. Musk recently voiced concern in a Twitter post, stating that AI could be "potentially more dangerous than nukes." Hawking is also wary about the dangers of AI, telling the BBC that "the development of full artificial intelligence could spell the end of the human race."

As we move into a future with self-driving cars, ethicists have brought into light the various questions that arise with such AI evolutions, like how a car might weigh the importance of its passengers as opposed to pedestrians in the event of an unavoidable accident.

But the future could be even more frightening. In 2013, United Nations representative Christof Heyns called for an end to the testing, production and use of military weapons that act autonomously without any human interaction, stating that "war without reflection is mechanical slaughter."

Experts estimate that we're only decades away from this kind of advanced AI being a reality, which is why now is the time to make sure global regulations are put in place. We too would like to avoid any *Terminator*-like situations.

Stephen Lambrechts

China wants a backdoor

EU, US and now China are requesting that internet companies hand over crypto keys.

Fearing that the internet is becoming a 'zone of lawlessness' due to widespread use of strong encryption and the Tor network, government officials around the world are calling for internet companies to hand over company encryption keys and allow backdoors into hardware and software.

Discussions have escalated following the recent Charlie Hebdo killings, with evidence appearing in a leaked document of an EU Counter-Terrorism Co-Ordinator recommending that companies be forced to give up their crypto keys, and an assistant attorney general of the US Justice Department also giving her full support.

While those discussions continue to occur, the Chinese government has taken things one step further, adopting new regulations that require companies that provide banks with computer equipment to submit to invasive audits, hand over secret source code, and build backdoor access into its software and hardware.

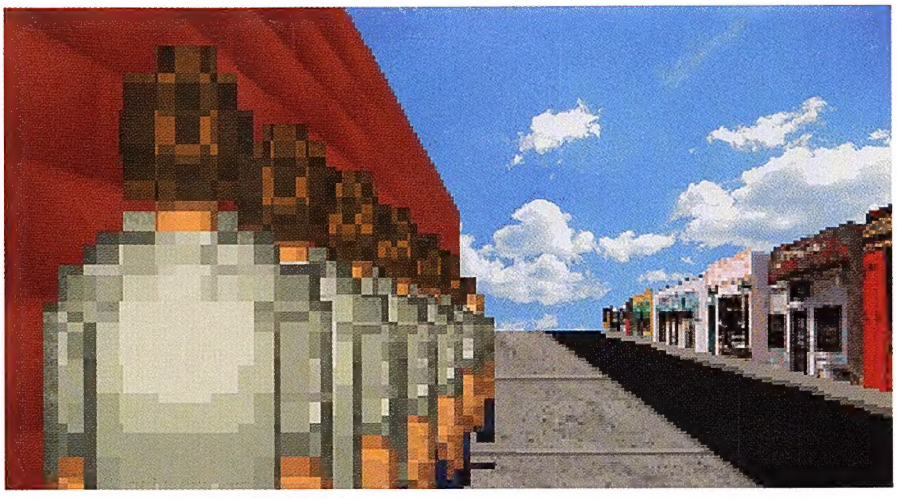
The Chinese government also necessitates that companies build ports for Chinese officials to monitor data, and create other methods for public security authorities to surveil data for terror threats. **Stephen Lambrechts**

Qantas to offer in-flight VR

First-class passengers can 'escape' long flights with a VR headset.

Qantas is teaming up with Samsung to add the latter's Gear VR headset to its list of first class and airport lounge perks. The virtual reality goggles that were originally due to be released to Aussies in December last year, but still haven't hit shelves. In late January however, Qantas announced a deal that will see the goggles fill the frontmost isles of selected A380 flights to and from Los Angeles by mid-March. The three month trial will be available earlier in the first class lounges of Melbourne and Sydney airports, with headsets showing basic content like walkthroughs of LAX airport and unique live plane footage. Qantas's first content partner, Tourism NT, has started working on a 3D virtual tour of Kakadu National Park.

Though the content will initially be limited — currently it is virtually non-existent — VR on planes seem like a perfect fit. There isn't enough room for you to have your own decent-size screen and anything that helps you forget that you're in a cramped tin can thousands of meters in the air is a good thing. The future of flying may be a lot more bearable in a virtual world.
Joel Burgess



Networking for a better deal.

Choice champions Aussie's right to use VPNs for international shopping.

International retailers with ecommerce stores will often have different prices — and sometimes even different products — for the different countries they operate in. While that may be logical for real-world stores that are located at opposite ends of the globe, when a US or other foreign web-based store is no easier — or even more difficult — to use simply because the shopper is in Australia, that geographical distinction starts to seem a bit anti-competitive — something we've discussed multiple times over the years right here in the pages of *APC*.

It appears we're not the only mag thinking this, with consumer advocate *Choice* having recently published their support for the use of VPNs by Australians to obtain the best prices. *Choice* spokesman Tom Godfrey said that VPNs open a global marketplace that is good for consumers and competition. "Businesses use all sorts of tricks to try to keep Australian consumers out of overseas stores. A VPN unlocks a world of options and savings," said Godfrey. "Consumers shouldn't be locked in to a bad deal just because they live in Australia."

After reviewing 12 VPNs, *Choice* recommended HideMyAss and PureVPN as the equal best of the services which provide anonymity, international shopping and legitimate overseas entertainment options for consumers.
Joel Burgess

EFF launches campaign to end mass surveillance

Non-profit organisation proposes a strategy to restore digital privacy.

The Electronic Frontier Foundation (EFF) has spent many years fighting for the digital world's civil liberties. The international organisation has now delivered a detailed strategy that aims to end mass surveillance of our online activities by government agencies. The strategy, which would be an international effort, aims to shield internet users across the globe, including non-US citizens, who aren't legally protected against the National Security Agency's warrantless spying by the American constitution. Also included in the EFF's game plan are steps to pressure tech companies, advising them to harden their systems with tougher encryption and more secure communication tools. The organisation also hopes to encourage average internet users to take measures to safeguard their own data, alongside broader goals such as developing new legal principles, finding new champions for surveillance reform, changing laws and bringing a general level of transparency to surveillance laws and practices. The EFF also suggests joining or creating a local digital rights organisation, as well as supporting politicians and companies that take a stand against government espionage.
Stephen Lambrechts

US$129,000

20 YEARS OF GAMING

Sony's PlayStation celebrated it's 20th anniversary late last year, with the company releasing a specially designed, grey-coloured PS4 to commemorate the original PlayStation going on sale in Japan in 1994. While the limited-edition console quickly sold out, one particularly-keen buyer has successfully snatched up the first of the customised models — the one which features that all-important serial number of '00001'. The purchaser made the successful bid of US$129,000 through an online auction set up by Sony, with the proceeds being donated to charity.

252 kilobytes

GLOBAL 'LIKES'

In its continued efforts to provide developing countries access to online services, Facebook has released a mobile app sized at only 252KB. Made to be a lite version of its official app (the full iOS app comes in at a hefty 70.1MB), this stripped down version is designed specifically to work on 2G networks, with reduced functionality that provides basic access to the service but uses minimal data. Currently the app is Android only, and is being tested exclusively in a select number of countries including Nepal and Nigeria.

123456

THE PASSWORD IS PASSWORD

With the recent high-profile attacks on companies such as Sony, now is the time to think about just how secure the many (many) passwords you have are. Security firm SplashData has released a report revealing the most used passwords of 2014, with '123456' topping the list. New additions such as 'batman' and '696969' also featured in the top 100 most popular passwords. The most common passwords were related to sporting teams, children's names and curse words, with sequential characters on keyboards also popular.

65%

DO YOU TAKE BITCOIN?

Though it's often promoted as the future of money, a recent survey has revealed that 65% of Americans aren't familiar with what Bitcoin actually is. Bitcoin is a type of digital currency that's stored electronically, with coins being 'mined' using computers all over the world, which slowly solve increasingly-complex mathematical problems. It's different to normal currencies in that it's decentralised, meaning that no single institution controls it. Despite masses of recent media coverage, much centring around its legality, this report shows that Bitcoin has a long way to go before it can truly become the currency of the internet.

81%

AN ANDROID A DAY KEEPS THE APPLE AWAY

In numbers that, at first glance, seem a little astounding, a recent report has revealed that the Android OS was used by 81% of the 1.28 billion smartphones that shipped in 2014. Being featured in over one billion devices, Android is the clear 'winner' over Apple — with the latter only responsible for a mere 15% of the world's smartphones, having shipped 193 million units. Last year's smartphone sales were impressive, with that 1.28 billion number being 280 million up on the 1 billion shipped in 2013. That increase is largely thought to be thanks to continued growth in emerging markets such as China and Indonesia.

VICTORIOUS

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technotes

» GEAR WE WANT

THALMIC LABS MYO

WWW.THALMIC.COM | US$199 ON PRE-ORDER

The Myo is a gesture-controlled armband for smartphones, PCs and Macs, using muscle sensors to enable the wearer to control devices with a flick of the wrist or the clench of a fist. It can be used with apps such as Keynote, so presentations can be controlled on your PC/Mac by waving left/right to move between slides and making a fist to annotate. On an smartphone you can control music mid-jog using air gestures.

POLAROID ZIP MOBILE PRINTER

WWW.POLAROID.COM | US$129

The Polaroid Zip pairs wirelessly to Android and iOS devices and instantly prints 2 x 3-inch colour photos via the free app. It weighs just 186g and can be taken anywhere. It's also not much bigger than a smartphone and is less than an 3cm thick. The only physical control is a power button, which has been seamlessly integrated into the unit's sleek design. The app also features the kinds of speedy editing tools you would expect, like brightness, contrast, tint and retro/HDR filters. This tiny printer could be just the thing to make us fall in love with glossy prints again.

B&O BEOSOUND MOMENT

WWW.BANG-OLUFSEN.COM | US$2,700

Bang & Olufson is keeping up with the times by creating a music system that integrates your music collection and streaming services with a touch-sensitive wooden interface and a colour wheel. The wooden side of the detachable control panel is completely minimalist, working a bit like an iPod click-wheel. The colour wheel allows you to set your mood, with the Beosound Moment choosing music to match. The luxurious nature is obviously crave-inducing, but what B&O has done on the usability side could be equally impressive too.

HP Z34C

WWW.HP.COM | $TBA

People often make fun of curved displays as being pointless gimmicks, but they miss one very important fact: they look so cool. This new 34-inch screen from HP is awesome in many other ways too, particularly its ultra-wide 21:9 aspect ratio (cinema widescreen) and detailed 3,440 x 1,440 resolution. HP also announced a 27-inch 5K display to match the Retina iMacs, but since most PC graphics cards max out at 4K, it doesn't do that much for us... yet. Also, it isn't curved.

MERCEDES-BENZ F 105

WWW.DAIMLER.COM

$QUITE A LOT!

Self-driving cars are coming, and the roads will likely be a lot safer for it. But they'll also be a lot more comfortable – at least, if we all buy our new autonomous cars from Mercedes. The F 105 is Mercedez-Benz's answer to what cars of the near-future should be like: its four chairs all swivel round, so passengers can enjoy a lounge-like experience while on the move. Six displays provide plenty of feedback, and there are still some good old-fashioned car controls, if you get nostalgic.

CARVEY

WWW.INVENTABLES.COM

$TBA

Like a reverse 3D printer, the Carvey meticulously carves shapes out of blocks of material. You can create designs in the Easel software that's designed to pair with Carvey, and then start cutting great 3D sculptures out of wood, soft metals, plastics, linoleum, and more. Unleash your inner sculptor on some aluminium, or just carve models out of wood. It etches too, for creating things like personalized jewellery. Funded by Kickstarter, units are set to be available some time later this year. ■

Cut to the chase

WHAT IS IT?
A complete update of Windows.

WHEN IS IT OUT?
It will launch "later in the year" in 2015.

HOW MUCH WILL IT COST?
For Windows 7 and 8.1 users, it will be free for one year.

Windows 10: The big reveal

Microsoft's event on January 21 revealed exciting news about the next version of Windows — here's what you need to know.

We've known about Windows 10 for a while now. Back in September, Microsoft announced it would skip a generation and name the next version of Windows, version 10, and bring back the Start menu. Now in January, after a 2.5-hour event, we know a lot more.

As well as many new enhancements to the operating system and apps, we discovered Universal Windows 10 can stream games from Xbox One and power a new holographic headset called HoloLens. So let's get on with it, there's plenty to talk about!

WINDOWS 10 WILL BE FREE

First, the good news – Windows 10 will be free. That's if you're running Windows 7, Windows 8 and Windows 8.1. Confusingly, Microsoft announced this by saying it will be free "for the first year". To clarify, Microsoft didn't mean it was a free upgrade for the first year, but that you can upgrade for free within the first year. So, it's not a subscription: it's a free, one-time upgrade from Windows 7 or 8 to Windows 10, which includes free future updates, the way Windows has always worked.

This could be the biggest change in Windows usage in years though, because there will be no reason for the majority of PC users not to upgrade to the latest version. This has important considerations for developers, who will have a less-fragmented audience to make their apps for, and also for gamers. Back when Windows Vista launched, those who didn't upgrade missed out on DirectX 10. Vista didn't have a lot of fans and was poorly received. If Windows 10 suffers the same fate, DirectX 12 (and we're sure the full features of DX 12 won't be available on Windows 7) will go under-used. But why would that happen if Windows 10 is free?

CONTINUING ENHANCEMENT

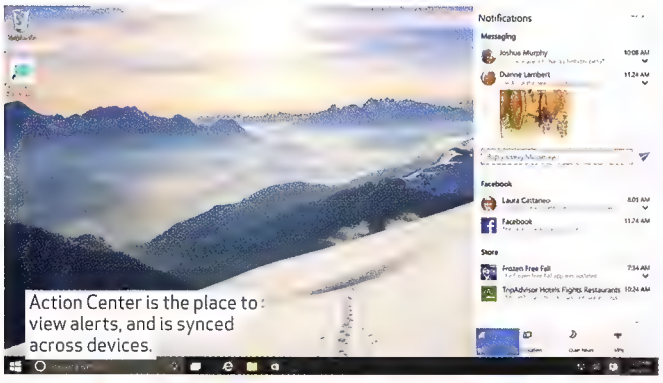
Let's look at what's new in Windows 10. Microsoft is grateful to the people in the Windows Insider Program (who have been testing the latest build of Windows 10 and providing feedback on how it's working so far – you can sign up at **insider.windows.com**) and, thanks to their suggestions, has combined the Settings app and Control Panel into a new Settings area as a result. Another improvement is the Action Center (your central place to view alerts and take actions to keep Windows running smoothly) is now synchronised across all your devices.

HELLO, CORTANA!

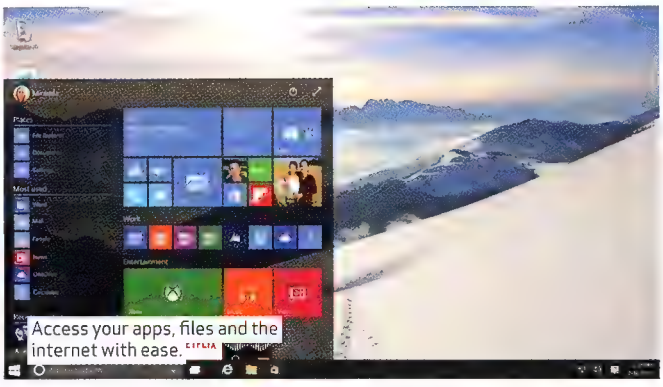
As expected, it turns out Cortana, Microsoft's virtual assistant, the twin-sister to Apple's Siri, is also being ported over from Windows Phone, so you can ask your PC natural-language questions and get answers. Cortana can also do things such as show a PowerPoint presentation you need for a meeting, launch apps or queue up your music. Cortana will roll out to Windows Insiders over the coming months.

WINDOWS 10 FOR PHONES

According to Microsoft's Joe Belfiore, Windows and tablets under eight inches are now being treated the same, and he demonstrated Windows 10 running on a Lumia 1520. This means the end of the Windows Phone operating system as we know it, so your phone will be designed to be a companion to your PC more than ever before, with shared settings and 'universal' apps that work across all



Action Center is the place to view alerts, and is synced across devices.


Access your apps, files and the internet with ease.

That all- important first look at the Windows 10 start screen.

Microsoft devices (see more below). Settings, for example, is now a universal app that works on all types of devices. Microsoft assures us Windows 10 for mobile should be available in February for Windows Insiders.

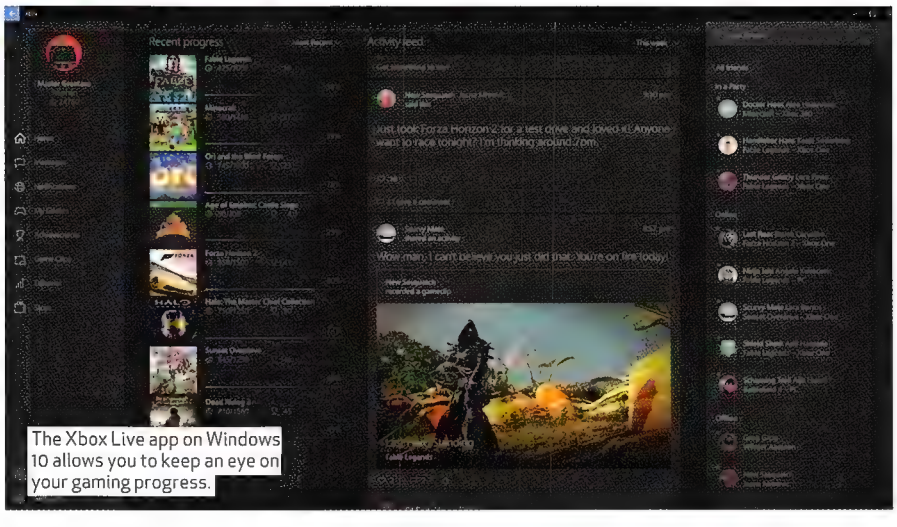
OFFICE FOR TOUCH-FIRST

Microsoft demonstrated Office for touch-first, showing how the Ribbon, from the desktop apps, is now available on phones and smaller tablets. This will be built into Windows Phones running Windows 10. There's also a Universal Outlook app that will work across phones, tablets and PCs (Word's engine is used as the editor).

BETTER STOCK APPS

In Windows 10, IP messaging (which incorporates everything from instant messages to video and phone calls via your PC), including the popular Skype service, is going to be integrated into the messaging and calling functions. So, we'll be able to use several services all from one, connected, place.

There's also a new Photos app that will take over from the existing Windows 8 Photos app (which was starting to look very long in the tooth). Microsoft demonstrated stacks of apps – including People, Photos and Calendar – working on both phones and PCs. People looks a lot better than it did in Windows 8, too. You will be able to store your music in OneDrive using the Music app as well.

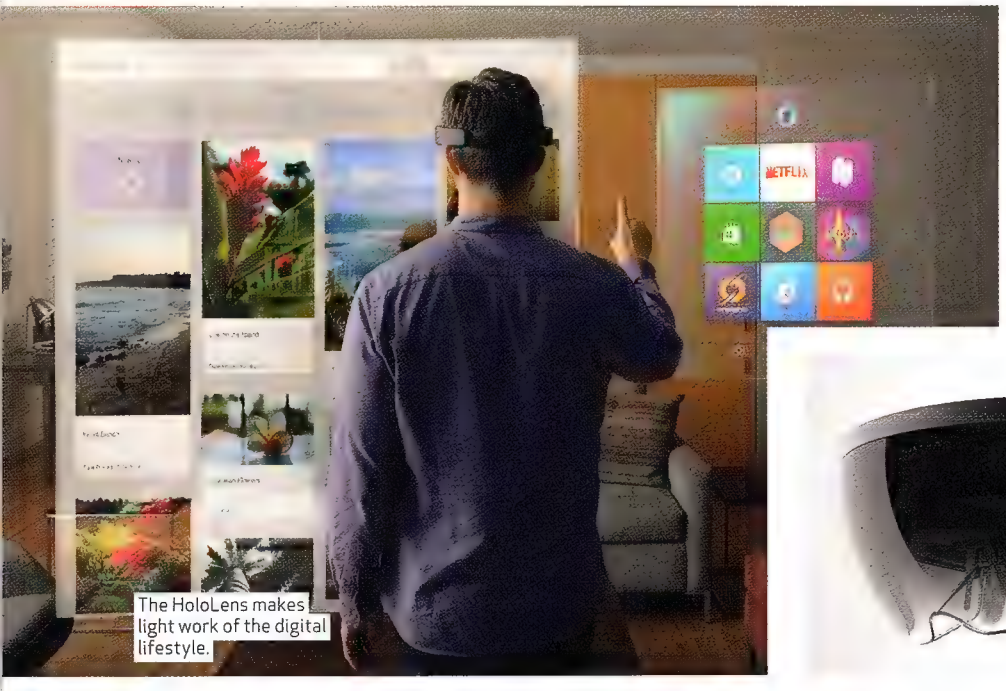


The Xbox Live app on Windows 10 allows you to keep an eye on your gaming progress.

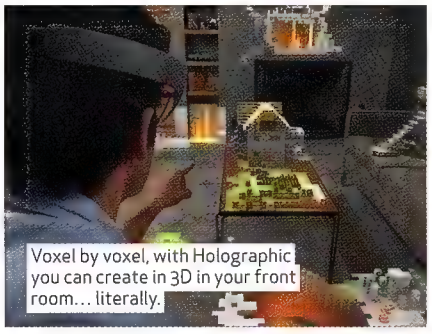
A NEW WINDOWS 10 BROWSER

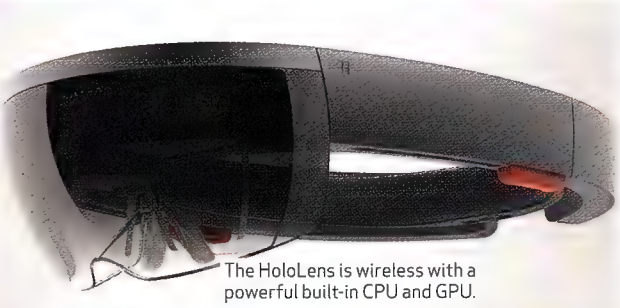
Project Spartan (still a codename for now) is a new browser that comes as part of Windows 10, but it won't be available immediately for Windows Insider users. It has a new look and feel, although tabs are still along the top, so it doesn't look a million miles away from the browser you already use. It will also be coming to phones.

Spartan does come with some nice features, though. You'll be able to highlight and share things within articles – either with a pen or your mouse. You have the ability to save



The HoloLens makes light work of the digital lifestyle.


Voxel by voxel, with Holographic you can create in 3D in your front room... literally.


The HoloLens is wireless with a powerful built-in CPU and GPU.

them to OneNote (in the cloud) or share via another app. There's also an Offline mode in Spartan – so you can read articles from your Reading List offline at your leisure. Cortana is integrated, too, as you might guess, so you'll be able to speak out your web searches, and PDFs are also supported in Spartan, just as they are in Chrome.

WINDOWS 10 GAMING

The features we're probably most excited about (apart from the announcement of HoloLens, but more about that later) are the gaming features of Windows 10.

Phil Spencer, head of Xbox, was present at the event to talk about gaming on Windows 10 and how it will be even more personal. Microsoft announced its revamped the Windows 10 Xbox app to support game streaming from the Xbox One console. This means Windows 10 PCs and tablets can play games that are running on an Xbox One console live. Microsoft demoed the game streaming by pulling up the Xbox app on a Surface Tablet running Windows 10. The app showed the games installed on an Xbox One connected to the same network. To play a game on the tablet, Spender right-clicked Forza and selected a 'Stream from Xbox One option', then started driving with a synced Xbox One controller.

The game is likely using a similar video-encoding technique (encoding video on the host Xbox One, then decoding it on the client PC or tablet) to other streaming services, such as Steam's In-Home streaming. To stop playing the game, Spencer pulled up the Xbox One UI and shut the console remotely.

SURFACE HUB

At the event, Microsoft announced the Surface Hub – a new piece of hardware that can run Windows 10. This interactive whiteboard and meeting-room video conference screen replacement, is essentially an 84-inch 4K screen (well, all-in-one PC) on which you can write and collaborate on to beam content across from any device. You can share content to others, making it a "great tool to create and brainstorm". But unless everybody is using a Windows 10 device it could be somewhat limited in use.

HOLOGRAPHIC POTENTIAL

The final announcement from Microsoft was a surprise. Microsoft announced a new component of Windows 10 called Windows Holographic. This is a version of its OS built for an augmented reality headset called the HoloLens. Unlike a virtual-reality headset, such as the Oculus Rift, which create images on an LCD display and immerses you in a virtual environment, Microsoft's HoloLens uses transparent lenses to project images into the world around you.

Microsoft used a sizzle reel for Windows Holographic to show off potential uses: building Minecraft-style voxel constructions on your living room coffee table, simulating the Martian landscape, or creating industrial design in three dimensions. Then Microsoft brought out a HoloLens headset to demo it live with a new program called HoloStudio.

HoloStudio is a bit like a 'My First 3D Modelling Program.' Microsoft

HoloStudio can output images to a 3D printer.

demoed the headset by putting together some basic shapes to assemble a simple quadrocopter. The payoff for HoloStudio is it can output files to a 3D printer. The HoloStudio demo didn't show an interaction between 'holograms' and the real world. It's one thing to be able to project those images for the viewer wearing the headset – it'll be more difficult to integrate those projections into real tasks in a meaningful way, such as adding 3D modelling data to the motorcycle in the sizzle video.

The HoloLens itself is an impressive-looking headset. It's wireless, and Microsoft says it has a powerful built-in CPU and GPU, with a third "holographic processing unit" designed to handle reading data about the world around you. The holographic processor "gives us the ability to understand where you're looking, your gestures, your voice."

We'll be getting a hands-on (and eyes-in) demo of the HoloLens, so stay tuned next issue for our impressions, and our thoughts about how it could fit into your future. ■

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tech mags

» EPINIONS

NAS FOR DUMMIES

I am an *APC* subscriber and I really enjoy the mag. Having said that I confess I understand about 20% of it but that makes it really good learning material and it has been invaluable in assisting me in technology options.

So, I recently bought a QNAP 470 Pro NAS mainly to use as a media hub, although I am discovering it can do so much more. My issue is that I am a technology enthusiast but my understanding is below the level needed to make full sense of the QNAP support and tutorials. Can you please suggest an appropriate basic NAS intro material? I have not used servers before.

Paul Hogan

*Ed replies: **Unfortunately while there's a fair amount of similarity between the NAS offerings from major brands such as Synology, Thecus and QNAP, the OSs they use and the features they provide differ enough that a general introduction to NAS boxes probably won't cover your QNAP-specific needs. Wikipedia's NAS article at en.wikipedia.org/wiki/Network-attached_storage is a good introduction to them as a whole, but by the sounds of it you're probably a bit beyond this. The best way to learn, in our experience, is to play around with what you've got — just make sure to note down any changes before you make them, so you can go back and undo them again if something doesn't work like you expected!***

SPRING CLEANING

So Windows 7 has been installed on my father's computer for some time now, a year or two perhaps. It came to my attention when he complained to me the other day about why his computer was taking so long to perform the usual tasks (open Outlook, photo albums, browser) that there's probably a lot of temporary files built up on his computer. I know from experience that Windows installs seem to slow down after a while and my fix is usually a format and re-install after 6 months to a year. So I ran Ccleaner, as I have done in the past. This time however it has not seemed to help the situation, if anything it's become worse, I had news of a bluescreen just yesterday. Is there such a thing as a Microsoft Windows 7 installation cleaner, or re-fresher? Something that takes the Windows system back to the way it was when installed. I know a bluescreen can be caused by many different things, but my first thought is to a driver issue – but where has that come from so randomly? I know I can't be alone with this issue of Windows installs becoming clogged, and all of a sudden programs start taking a long time to open. Or when I get the dreaded "this window is not responding", which then frustrates me when I open task manager to see that a mere 1% of the CPU resources are being used. (This must get on your nerves too)

Andrew Smith

*Ed replies: **On an older PC, bluescreens might just as likely be caused by failing memory or a hard drive — but new drivers can be automatically installed as part of Windows Update, so that's certainly a possibility too. Regarding a 'refresh' of Windows, this feature's available in Windows 8, but unfortunately not in Windows 7. If the bluescreens definitely started recently, you may want to try a using System Restore to return the PC to an earlier state, before the errors started. Otherwise, a clean re-install is your best option — just make sure to back up your father's important data first!***

STOP MOTION VIDEOS

I have a Windows 8 tablet on which I have moved all the Windows data folders (OneDrive, Documents, Downloads, Pictures, Music and Videos) onto a micro SD card. Just recently I have noticed that videos recorded with the camera are jerky. There will be several seconds of smooth video and then a couple of seconds of frozen video. I have traced the problem to the SD card. It is a class ten and only half full so should have no problems saving the video. I assume that a SD card works the same as SSD storage when deleting files and therefore requires optimising? The optimising option is not available in Windows explore. Is there any way I can optimise the card without doing a full reformat?

Carl Francis

*Ed replies: **We've looked into this Carl, but unfortunately haven't been able to find any definitive answers. We've found other reports of SD cards slowing down, but its unclear if SD supports TRIM — it may depend on the card. However, the accepted way of fixing slowdown seems to be to use the official formatter utility from the SD Association, which is available here: www.sdcard.org/downloads/formatter_4/. You'll need to back up your data to elsewhere first, but you should be fine to copy it back after a reformat.*** ■

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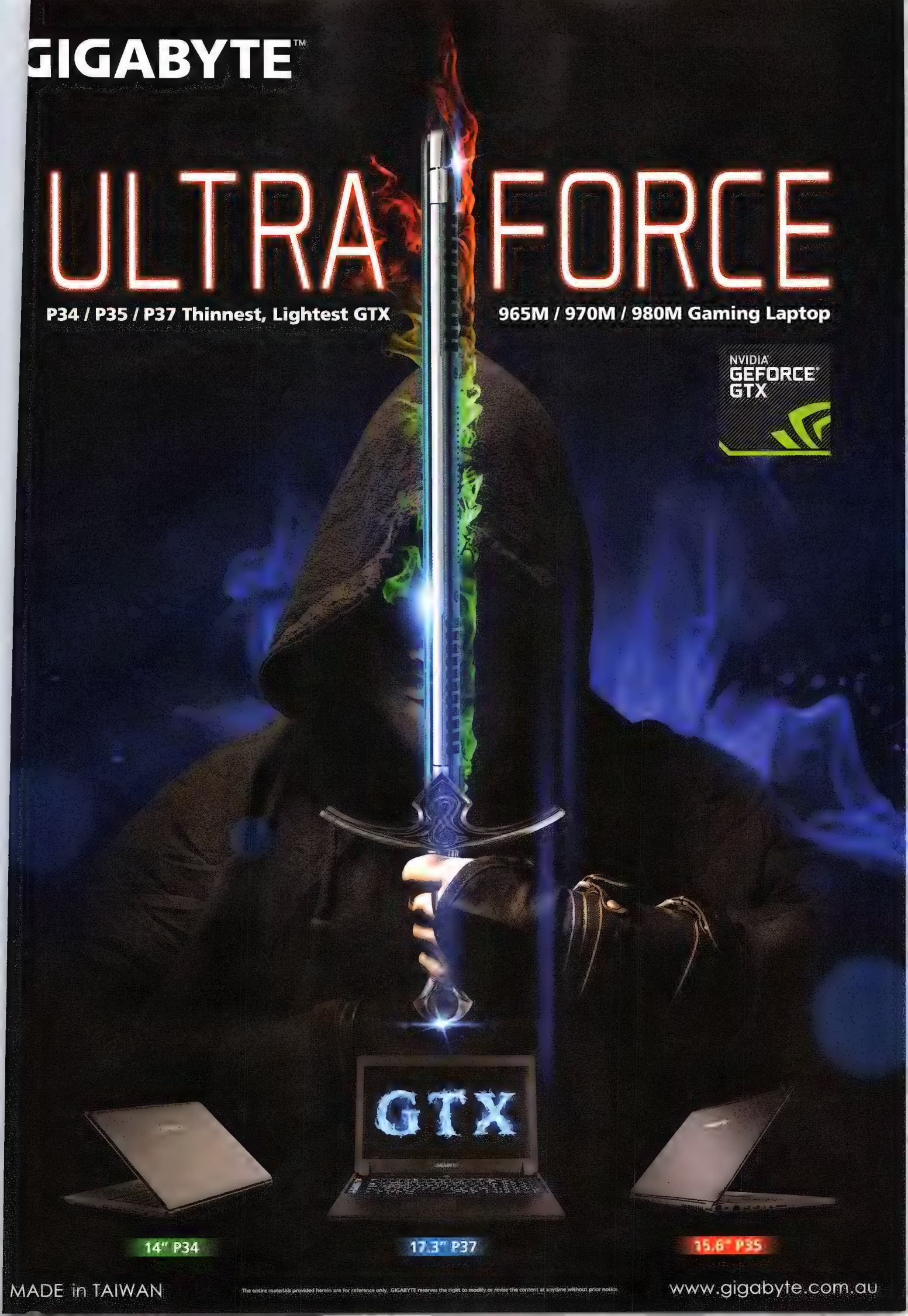
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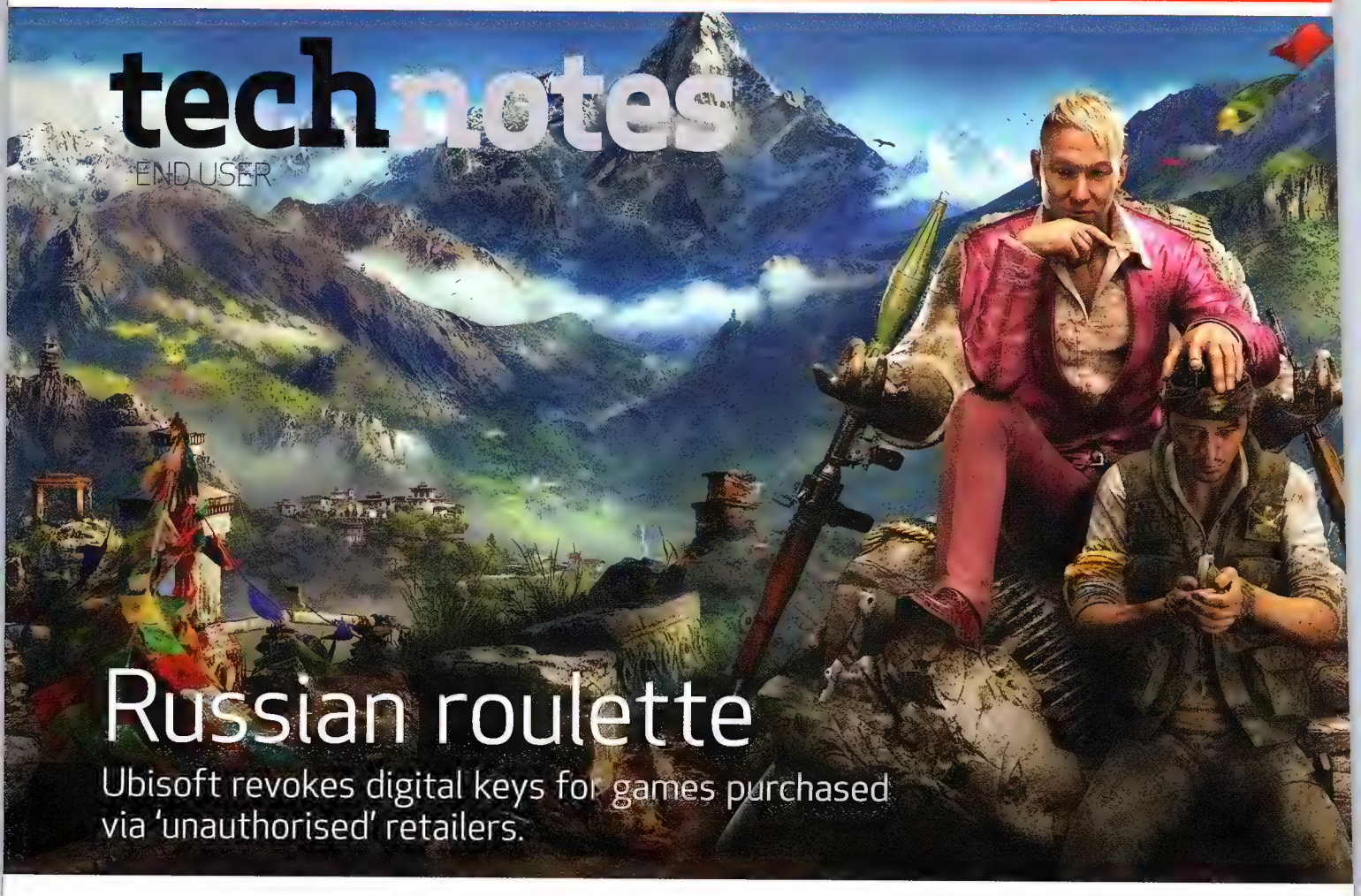

Russian roulette

Ubisoft revokes digital keys for games purchased via 'unauthorised' retailers.

In a move that has angered many gamers, Ubisoft recently revoked a number of keys for its games that were purchased from third party retail web sites.

According to a statement issued by the publisher to several gaming web sites, Ubisoft revoked the keys with claims that they had been "fraudulently obtained and resold", which caused the games to suddenly disappear from the libraries of people who purchased them. Many users have come forward stating that they purchased the keys from what they thought were legitimate web sites, such as G2A and Kinguin.

Understandably, it is well within Ubisoft's interests to make sure that its game sales aren't being exploited by regional price differences, however expecting the onus to be placed on the average consumer (who may or may not have known better), rather than the web sites doing the exploiting, is more than a tad unreasonable.

In response to a query posed in Ubisoft's forums, an Ubisoft community manager stated that "if you wish to know why a code is revoked – your retailer should be able to answer and supply a new code or a refund." It's a solution that ultimately intends to burn the retailer that sold the codes – but one that does so at the expense of the consumer.

A consumer might resort to purchasing a game from a third-party web site for a number of reasons. One user in Ubisoft's forums claimed to be a Belgian living abroad in Poland, who simply wanted a version of *Far Cry 4* in his native language without being taken for a ride due to the immense exchange rate between the Euro and the Polish Zloty (1 EUR = 4.18644 PLN at time of writing).

Clearly, some believe that individuals like this user should be at the mercy of the regional pricing and versioning model that's available to them. We think that's crazy, but what irks most about this sentiment is that it suggests that hunting around for the best deal online is a bad thing, and that paying for something from an overseas retailer at a cheaper price is illegitimate. I suppose these people have never purchased a product from eBay or Amazon before.

Ubisoft representatives have often pointed out the high rates of piracy on PC, so it's an odd tack to punish paying customers – leaving them unable to play the games they've paid for, while pirates continue to enjoy the very same games completely unaffected.

After much public scrutiny, Ubisoft has since backpedaled on its decision – to a degree – telling *Game Informer* that it was 'reinstating keys for consumers who already had successfully activated and started playing the games.' However it concluded by stating that "any remaining fraudulently-obtained and resold keys have been deactivated."

With digital distribution of games more pervasive than ever, we hope that the push for competitive pricing continues – and that road bumps like this aren't indicative of what lies ahead.

Stephen Lambrechts

ENDUSER

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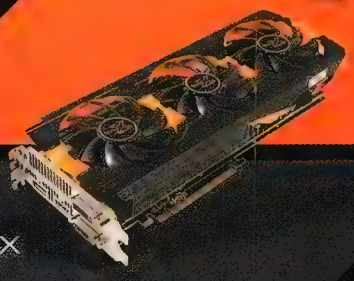

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Nvidia GeForce GTX 960

Does the green gaming giant's new mid-range offering live up to the high standards of its GTX 760 predecessor? Dave James and Dan Gardiner find out.

The GPU sweet spot. That's how Nvidia is referring to the GTX 960, its new mid-range graphics card based on the latest Maxwell architecture. The bare minimum. That's how we're going to be referring to it. Nvidia has released the necessary replacement for the last remaining Kepler-based graphics card in its stack, the GTX 760, and there is some good overlocking potential to the new GTX 960. Though we still can't help but feel a little underwhelmed.

With the first-gen GTX 750 and 750 Ti Maxwell cards completing the low-end, and the GTX 970 and 980 rocking the high-performance world, the Maxwell stack is now pretty much feature complete. We're still waiting on the ultra-enthusiast cards to tip up later in the year to spoil the next expected AMD Radeon launch, but for the consumer segment, this is pretty much your lot for the foreseeable.

RAMP IT UP

So, what have we got then? Nvidia has created a 'virtual reference design' for the GTX 960, which means manufacturers have free reign putting their own cards together. It almost means there's no real base spec for the new card. That in turn means the first flush of GTX 960s we're seeing are overclocked versions right from the off.

But while the clockspeeds are more widespread than usual, thanks to a lack of Nvidia-led limitations and the wide variance of boost clocks, the core specs of the GM 206 GPU which powers the 960 are set in stone. The new mid-range Maxwell chip has a total of eight SMMs which gives the GTX 960 a full 1,024 CUDA cores, 64 texture units and 32 ROPs.

> "Nvidia has created a 'virtual reference design' for the GTX 960, so manufacturers have free reign putting their own cards together."

That's actually a little below the older GTX 760, which seems to have been a bit of an anomaly, using as it did the same Kepler GPU as the top consumer SKUs rather than the second-tier GPU the GTX 660 and GTX 560 used. That does, though, add to the general feeling of the GTX 960 being a bit of a sideways step in the mid-range.

Not doing anything to dispel that feeling is the memory architecture. Using a 128-bit memory bus for its 2GB of GDDR5 memory just seems like MechaScrooge territory. Nvidia's practised response is that the GM 206 GPU uses the same improved memory

Verdict

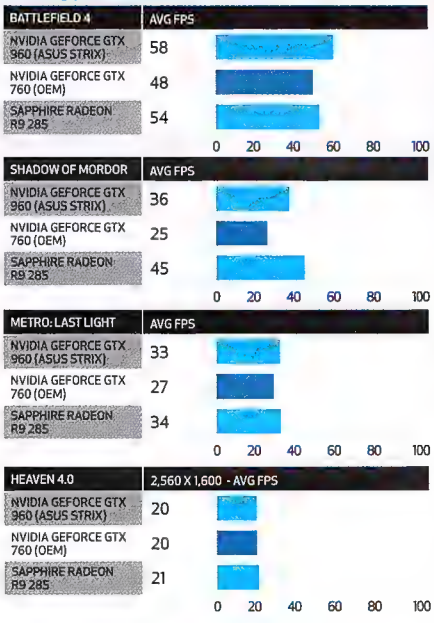
Features	★★★½☆
Performance	★★★★½
Value	★★★★☆

A mid-range card that gets the job done, but that's about all.

★★★★☆

LABS BENCHMARK RESULTS

Gaming performance


BATTLEFIELD 4
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SAPPHIRE RADEON R9 285 54
0 20 40 60 80 100
SHADOW OF MORDOR
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NVIDIA GEFORCE GTX 960 (ASUS STRIX) 36
NVIDIA GEFORCE GTX 760 (OEM) 25
SAPPHIRE RADEON R9 285 45
0 20 40 60 80 100
METRO: LAST LIGHT
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NVIDIA GEFORCE GTX 960 (ASUS STRIX) 33
NVIDIA GEFORCE GTX 760 (OEM) 27
SAPPHIRE RADEON R9 285 34
0 20 40 60 80 100
HEAVEN 4.0
2,560 X 1,600 - AVG FPS
NVIDIA GEFORCE GTX 960 (ASUS STRIX) 20
NVIDIA GEFORCE GTX 760 (OEM) 20
SAPPHIRE RADEON R9 285 21
0 20 40 60 80 100

compression techniques which made the GTX 980's 256-bit memory bus so effective.

Looking at the raw numbers though, doesn't make for great reading on that front. The memory bandwidth of the GTX 960 is a miserly 112GB/s, though Nvidia's compression wizardry puts that at an effective 149GB/s. Still, that's way short of the GTX 760's 192GB/s bandwidth or the Radeon R9 285's 179GB/s on its 256-bit memory bus.

It's probably a mid-range stunner in terms of gaming performance though, right? If that's what you've picked up from the tone of this review so far, you need to have a word with your intuition. The difference between a stock-clocked GTX 970 and the 960s we've tested this month lies 25 to 35% lower in the gaming benchmarks. By comparison, the difference between the GTX 770 and GTX 760 was less than 20%.

BUILT FOR ONE FIGHT

At $350, the GTX 960 is looking squarely at the Radeon R9 285, with the GeForce card trading benchmark blows with the AMD. It's almost as if that was all it had to do and no more. With new gaming cards we've come to expect either new levels of performance at a lower price point or new levels of efficiency. It's true that the GTX 960's standard TDP of 120W is impressively low, but with these overclocked launch SKUs, that doesn't necessarily translate into a massive saving, if any, in peak platform power.

One thing Nvidia has pointed to with the GM 206 GPU though is just how overclockable it is. Nvidia's quoted base clock is a still-pretty-hefty 1,126MHz, with a boost clock of 1,178MHz. The cards we tested this month never got close to that, with most hovering around the 1,400MHz mark under gaming load. That is mighty impressive, and we were able to boost many even higher thanks to efficient cooler designs across all the cards here. We saw a stable 1,502MHz on the GPU and 3,780MHz on the memory clocks – a stunning jump up from stock. But what does that translate to in performance difference? A couple of frames per second on average. If you're lucky.

QUIETLY DOES IT

Still, these cards are all amazingly quiet. Like many recent cards, the GTX 960 won't even start spinning its fans until the GPU starts to warm up – where exactly is up to the individual card maker. Under normal desktop load it all the cards we tested switch their fans off, but in all cases, the GTX 960 is such a cool-running part that even when those fans do start spinning, they're so slow you'll barely hear them.

But we still can't shake that vague feeling of disappointment. Maybe we've just been spoiled by Nvidia's recent GPU releases, offering a heady mix of performance and efficiency, but this latest card doesn't feel like anything we haven't seen before. The GTX 960 isn't going to be the card anyone rushes out to buy. No, they'll pick one up if they haven't bought a card in three years and because it's the only Nvidia option at this price point. That said, if you have around $350 to spend, we'd opt for an older GTX 770 – of which there are still some in the market – or an AMD Radeon R9 285 if you can't find one of the latter.

■ Dave James

$350 | WWW.ASUS.COM/AU

ASUS STRIX-GTX960-DC2OC-2GD5

One for the mini-ITX crowd.

ASUS's STRIX is the shortest card we tested at just 22cm (it's pitched as being perfect for slotting into smaller mini-ITX and micro-ATX cases, and it's hard to disagree), meaning it also has the smallest cooler – a twin-fan job that combines with some nice fat heat pipes. It comes with a decently aggressive stock overclock of the GPU (1,253MHz vs the 'standard' 1,126MHz) and RAM running at 3,600MHz, a fair bit higher than the Gigabyte and MSI cards. While the STRIX idled a bit hot at 42°C, under load it actually had the lowest temps, never rising above 65°C. And it managed some of the highest overclocks, resulting in sustained GPU boost speeds upwards of 1,540MHz, giving you an extra 10% on average speed bump. That said, it wasn't the fastest in actual framerates when overclocked. But there's a good array of video output ports and power wise, it only requires one 6-pin PCIe connector. Nice. ■ Dan Gardiner

Verdict

A very discrete and compact card that's quite cool under pressure.

★★★★½

$325 | WWW.GAINWARD.COM

Gainward GeForce GTX 960 Phantom

Run silent, run thick.

Gainward's Phantom cooler is weird, placing the fans in the 'middle' of the card, inside a large grill/heatpipe array. But they're very quiet and kept the card under 68°C in normal operation, and 71°C when overclocked. This is a thickset, two and a half slot-width card though, meaning it won't fit in some mini-ITX cases, such as the excellent Bitfenix Prodigy. In terms of speed, Gainward has revved this one right up, with the GPU at 1,279MHz and memory at 3,600MHz – the fastest out-of-the-box overclock we saw. The GTX 960 can run most games at 1080p with all the bells and whistles, and the Phantom's overclock meant it pipped the competition by a frame or two at that res. It overclocked quite well, too, with a slight lead at 1080p – although again, only by a frame or two. Still, this one's a little lower-priced than the rest, making it a good option – provided you're not building a mini-ITX system, of course. ■ Dan Gardiner

Verdict

The cooler's unconventional, but this one's high overclock and low price make it an appealing option.

★★★★☆

$360 | WWW.GIGABYTE.COM.AU

Gigabyte GV-N960G1 Gaming-2GD

Combines 'Gargantuan' and 'Gaming'.

Gigabyte's arguably gone a bit overboard with this, its top-model GTX 960. This is a huge card with a gargantuan cooler – and honestly, the GTX 960 doesn't really warrant it. That cooler's made up of a mass of copper heat pipes, aluminium fins and three large (but comparatively slow-moving) 75mm fans. That slightly laid-back design meant this one had the highest peak temp, though at only 72°C it was still well below thermal limits – and you can always ramp the fan speed up using the OC GURU II app. Despite needing two PCIe power plugs (one 6- and one 8-pin) we couldn't get this card to overclock as highly as the others – but that said, we're only talking 15MHz or so: 1,326MHz instead of ~1,340MHz. To its credit, Gigabyte isn't charging much more for this mammoth card, and although we lucked out on overclocking, the cooling hardware is hard to fault. ■ Dan Gardiner

Verdict

Its cooler is undoubtedly excessive, but as it doesn't really cost anymore its hard to argue with.

★★★★☆

$350 | AU.MSI.COM

MSI GTX 960 Gaming 2G

Runs cool and quiet… just like the rest.

Although it was originally clocked lower than the other brands, MSI delivered a last-minute firmware update to us that brought this card's clock speeds up to match Gigabyte's – a respectable 1,241MHz for the GPU core. The MSI's cooler is impressive, too; this is a weighty card with lots of metal, needing an 8-pin PCIe plug to power its 95mm fans – which switch off when the GPU gets under 50°C and max out at practically-silent 940RPM. And that cooler keeps the heat down, ranging from a very respectable 32°C when idle to 66°C under load. We saw good results in overclocking this one, getting the GPU core up to 1,446MHz although the RAM didn't perform as well, topping out at 3,686MHz vs the Gainward's 3,780MHz. As such, the latter managed fractionally faster frame rates. Not that you'd actually notice in the real world. A good, solid option on the whole, but not a stand-out. ■ Dan Gardiner

Verdict

With so little between these four cards, MSI's is as good a choice as any.

★★★★☆

GAINWARD

NVIDIA GEFORCE GTX

Extreme Silent

Extreme Cool

PHANTOM

GEFORCE® GTX™ 960

GOLDEN SAMPLE GLH GOES LIKE HELL

15% up

PERFORMANCE UPGRADE

New Phantom cooler design

Gainward GTX 960 Phantom, continue the elegant design of the first generation. The new Phantom comes with brand new fans design (Patent M456684/ZL201320139962.6) that includes

1) Removable fan design - each fan body can be removed to clean if necessary
2) 4 pieces of copper heat-pipe and copper base - better thermal performance
3) solid structure

With this new outstanding innovated thermal design and optimized product design Gainward GTX 960 Phantom delivers an extreme gaming performance for enthusiast gamers.

SINGLE BOARD PC

$45 | WWW.RASPBERRYPI.ORG

Raspberry Pi 2

Version 2 has been released, so we thought we'd check out the backward-compatible Pi to see how good this new one tastes.

When the Raspberry Pi appeared in 2012 few could have envisaged how popular it would be. In the years after its release the Raspberry Pi has become the most popular single-board computer on the market and spawned many imitators, but none with the rich community that has grown organically around the Raspberry Pi.

Since the release of the original Raspberry Pi there have been three versions of the flagship B model, starting at 256MB RAM and increasing to 512MB with the second B and B+. But in all of these models the system on a chip (SoC) has remained the trusty BCM2835 with an ARM 11 700MHz CPU. The community have done wonderful things with these resources but now the specification boost that they were waiting for has finally arrived.

In early February, the Raspberry Pi 2 launched and the original ARM 11 has been replaced with an ARM 7 CPU running at an improved 800MHz. But rather than stick with a single core, the new verision comes with four cores which speeds up the Raspberry Pi by as much as six times. To go with the new CPU, the amount of RAM has also been upgraded to 1GB. The rest of the hardware, however, matches that of the B+: a 40-pin GPIO, four USB 2 ports and 10/100 Ethernet. Physically the Raspberry Pi 2 also has the same dimensions as the B+.

> "The community have done wonderful things with these resources but now the specification boost that they were waiting for has finally arrived."

ON THE TESTING BENCH

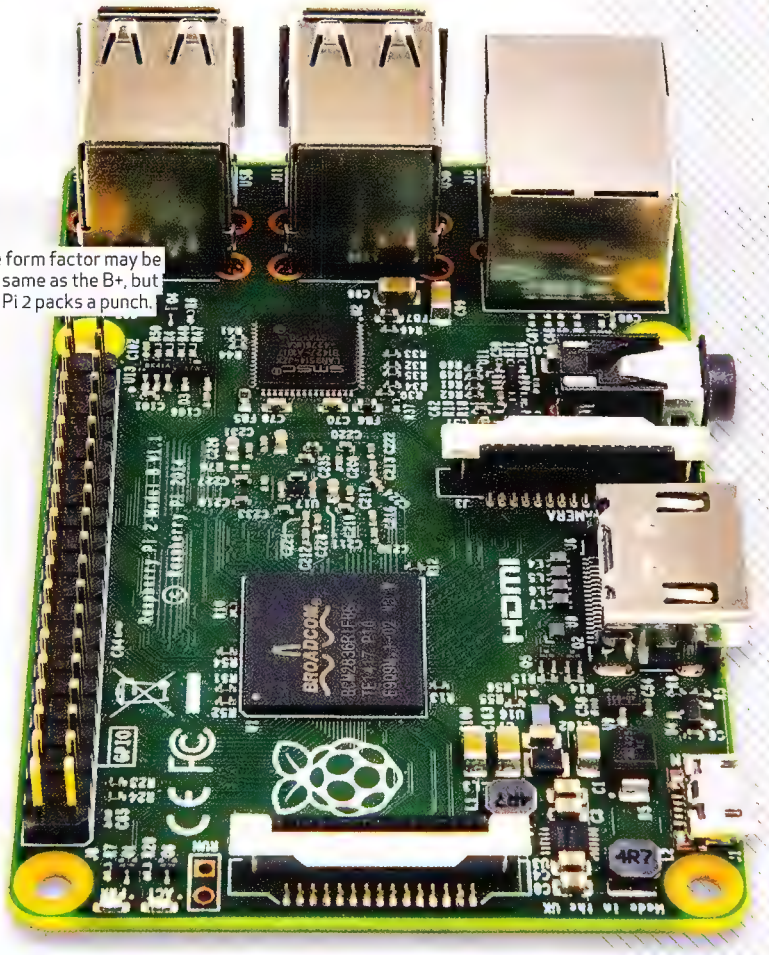
To show the improvements made to the Pi part deux, we wanted to run a few real-world benchmarks to show how powerful the new Pi actually is when directly compared to the B+.

The first test on our list is booting both Pis from cold to login prompt. The B+ managed this is in 33 seconds versus 17 seconds for the Raspberry Pi 2. We then set both Pis to boot straight to desktop and the B+ managed 42 seconds while the Pi 2 came in at 21 seconds – half the time of the B+! Once at the desktop we tested a few common applications.

Creating a new world in *Minecraft* took 42 seconds on the B+, and 21 seconds on the Pi 2. Loading IDLE 3 took 13 seconds on the B+ and a mere 4 seconds on the Pi 2.

Running SunSpider in the new optimised browser gave a glimpse at real-world performance. Over the suite of tests there was a 2.5 times boost in speed. Considering the complexities of multi-threading this sounds like a reasonable expectation. Even so, individual results showed a near four-fold increase on this unoptimised code.

The Raspberry Pi B+ and



The form factor may be the same as the B+, but the Pi 2 packs a punch.

SUNSPIDER BENCHMARKS

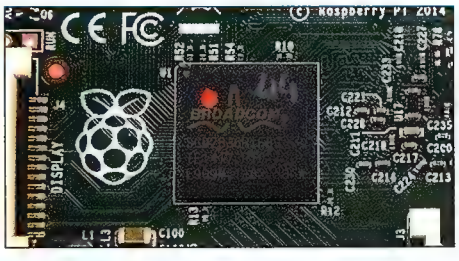
	Pi 2	B+	TIMES FASTER
TOTAL	2,760.9	8,178	2.96
3D	550.9	1427.8	2.59
CUBE	157.3	473.6	3.01
MORPH	167	296	1.77
RAYTRACE	226.6	658.2	2.90
ACCESS	211.9	435.9	2.06
BINARY-TREES	27.6	69.8	2.53
FANNKUCH	101.5	190.1	1.87
NBODY	52.8	118.7	2.25
NSIEVE	30	57.3	1.91
BITOPS	113.8	206.1	1.81
3BIT-BITS-IN-BYTE	9.9	18.2	1.84
BITS-IN-BYTE	22	35.6	1.62
BITWISE-AND	29.1	48.2	1.66
NSIEVE-BITS	52.8	104.1	1.97
CONTROLFLOW	28.3	64.6	2.28
RECURSIVE	28.3	64.6	2.28
CRYPTO	221.4	578.6	2.61
AES	112.4	287.6	2.56
MD5	60.1	162.2	2.70
SHA1	48.9	128.8	2.63
DATE	336.3	1269.9	3.78
FORMAT-TOFTE	171.5	641.9	3.74
FORMAT-XPARB	164.8	628	3.81
MATH	158.4	394.5	2.49
CORDIC	43.3	99.9	2.31
PARTIAL-SUMS	78.7	215.7	2.74
SPECTRAL-NORM	36.4	78.9	2.17
REGEXP	101.9	160.6	1.58
DNA	101.9	160.6	1.58
STRING	1038	3640	3.51
BASE64	63.3	178.8	2.82
FASTA	156.9	409.7	2.61
TAGCLOUD	177.8	617.7	3.47
UNPACK-CODE	514.5	2021.6	3.93
VALIDATE-INPUT	125.5	412.2	3.28

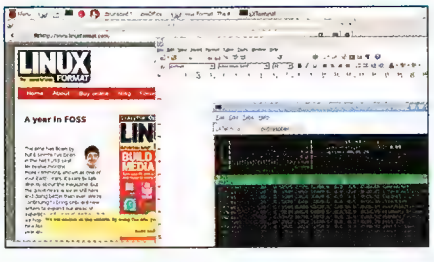
Pi 2 both come with the same Videocore GPU as before and in our tests there was a small improvement in FPS (Frames Per Second) for the Pi 2, largely thanks to the increased RAM present on the board. Our last test was file transfer speeds via Ethernet, for this we used scp to copy a 692MB Big Buck Bunny video file to each Pi. On the B+ we saw an average of 3.8MB/s and on the Pi 2 we saw 4.6MB/s, which is an 0.8MB speed increase.

The Raspberry Pi Foundation have released an updated Raspbian image which includes the ARM v7 kernel image necessary to use the new CPU. Applications written for the original Raspberry Pi are fully compatible with the Raspberry Pi 2 , though – building upon the rich projects that have been written since the initial launch of the Raspberry Pi.

The Raspberry Pi 2 fulfills a lot of the requests made by the community and provides a stable and well-supported platform for hackers, makers and learners to carry on with excellent projects for many years to come.

Les Pounder





Features at a glance

Powerful 4-core ARM v7 processor

The new Broadcom BCM2836 ARM v7 quad-core processor with 1GB of RAM yields results (see the benchmarks, above) that are four times the performance of the old BCM2835 SoC.

A great new Raspbian UI

Available since December, the new sleek Raspbian desktop runs well on the B+, but on the Pi 2 it feels like a responsive desktop that we'd expect to see on our main computers.

Verdict

Features ★★★★½
Performance ★★★★★
Value ★★★★★

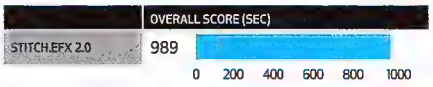
An almost perfect single-board computer that marries great hardware with a lively and supportive community.

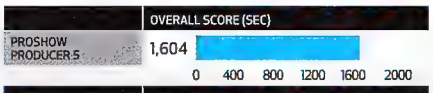
★★★★★

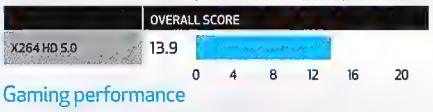
FROM $2,300 | WWW.HP.COM

LABS BENCHMARK RESULTS

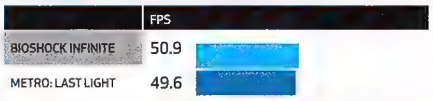
Performance Category

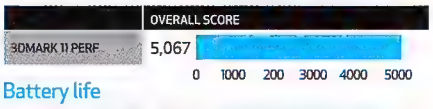




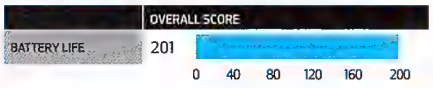


Gaming performance





Battery life



HP Omen

A gaming laptop offering plenty of temptation.

Right off the bat, you'll notice that HP's 15.6-inch Omen is one sleek-looking laptop. With its machined aluminum chassis and anodized black finish coupled with its thin 2cm body gives some added appeal. It's portable for its class too, weighing 2.15kg. While we were a little dismayed to hear it uses a 1080p monitor, it's an IPS panel that features a 72% colour gamut, providing gorgeous, saturated colors and a touchscreen; the first gaming laptop we've reviewed to offer one.

We were generally pleased with the keyboard, which offers seven customizable colour zones you can tweak using HP's Omen Control Panel software. The keys offer a satisfying amount of travel and feel tactile and you also get a column of six macro keys on the left of the keyboard. We weren't enamoured of the Omen's trackpad, however. Measuring 5.5-inches, it's so wide we often found our resting fingers interfering with swiping gestures.

On opposite ends of the trackpad are a pair of LED lights that pulsate with the sound of your audio. It's a unique touch that gives the notebook some personality. The speakers themselves are quite good and offer decent volume. Despite the Beats Audio branding, the audio here is balanced and not overly bass heavy.

Unlike the chassis, the Omen's specs aren't super fancy. It uses a widespread 2.5GHz i7-4710HQ CPU and HP's gone with a GeForce GTX 860M for graphics, the de facto GPU for thin gaming notebooks. And in regard to system RAM, configs starts out at 8GB; our maxed-out unit came with 16GB.

CPU performance was pretty average, ever so slightly faster than the Alienware 14's 2.4GHz i7-4700MQ processor. In GPU perf, we saw respectable gains between 20 and 60%. In short, our graphics tests remind us that the 860M is midrange. It will run the majority of modern games at high settings with smooth frame rates, but don't expect to max out games.

But while the laptop's performance didn't blow us away, neither did its fans (pun intended). The Omen isn't silent, but it's very reasonable under load. We'd go so far as to say HP found the perfect balance between performance and acoustics. The laptop is able to keep its cool by using dual fans that pull in cool air from the bottom, while expelling it through the back, meaning gamers needn't worry about sitting in a draft.

When it came to battery life, the Omen was pretty average. The first time we ran our video-rundown test, the notebook lasted a mediocre 2:52hr. When we turned off all the LEDs though, we got an extra half hour. Our biggest concern really pertained to storage. While we love that it uses the faster M.2 PCIe standard, we're put off that it doesn't support traditional hard drives. This means you're topped off at 512GB. Luckily, the installed drive is fast, and allowed the Omen to boot up in 11 seconds.

This may not be the most powerful notebook out there, but it's extremely polished and well-designed. Everything from its looks, portability, and thermals are top notch. While our decked-out unit cost $2,900, if you're looking for a more affordable configuration, we'd recommend the $2,700 model instead, which includes a 512GB SSD, 8GB of RAM, and an 860M with 2GB of VRAM. That model may not be the best, but it's still a pretty good Omen.

■ Jimmy Thang

Verdict

Features ★★★★
Performance ★★★★
Value ★★★½

Beautiful panel; sexy chassis; portable; good thermals. No hard drive support; very wide trackpad; not super-powerful.

★★★★½

The ASUS RT-AC3200 ensures that your network is fast and secure at all times.

The tri-band feature makes sure no one channel becomes clogged.

The RT-AC3200 is available for the Australian market in March 2015.

ADVERTISING FEATURE

SMALL BUSINESS ROUTER SELECTION GUIDE

How to choose a router that's right for you.

The criteria for selecting a suitable wireless router for small business are quite different to the criteria used for normal household usage. Despite the traditional need for the latest hardware specification, protection against internal and external network hazards is in many cases more vital for small business owners. This is due to the growing concerns of the ever booming internet threats such as external attacks, personal detail hijackers or dangerous web sites. Moreover, in a crowded environment such as a small to medium business, featuring a mixture of devices of various networking capabilities, it is also a tough challenge to not only keep every device connected, but for the devices to perform at their fullest.

These qualities set business routers apart from their residential counterparts. With over thirteen years of experience in the research and development in multi-purpose wireless routers, ASUS is proud to bring to the Aussie market its latest offering, the RT-AC3200.

SECURITY

Apart from the usual encryptions and guest network architecture to keep out unauthorised access to the network, the RT-AC3200 also features enterprise security features to guard your network against potential hazards. The ASUS AiProtection acts as a security guard for your network, featuring the ability to scan through all router settings for potential security holes, and quickly heal them. This is then backed by restricted access to known malicious web sites listed in the Trend Micro™ database. The Deep Packet Inspection (DPI) engine running on the router then guards your internal network against common internet-based attacks, while constantly filtering through all network packets leaving the internal network to ensure even infected devices will not communicate personal information and/or infected status to external parties. For IT managers with needs to offer only restricted access to internal members or guests, AiProtection also allows the blocking of access to keywords and URLs as well as time restrictions to guests, ensuring no security holes are left open.

CONNECTIVITY

In order to deliver smooth and uninterrupted connectivity, the RT-AC3200 features the intelligent Tri-band Smart Connect technology that dynamically assigns each connected device into the three available bands based on real-time status of device capability, signal strength and how busy each band is, ensuring perfect connectivity out of the box. On the top of that, the clever yet intuitive Adaptive QoS (Quality of Service) engine prioritises the WAN (internet) bandwidth to ensure every last bit of WAN bandwidth is put to best use. All the while the integrated Traffic Analyser also gives the IT managers an at-a-glance view of how network resources are consumed by each individual user for easy management of network resources. Devices that simply need to minimize network ping time, such as servers, can also utilise the four Ethernet ports powered by Hardware based NAT (Network Address Translation) for up to 5x faster pings than traditional software based solutions. This once again opens another opportunity for better and smoother connectivity.

WHAT DOES THIS MEAN FOR YOU?

With the performance and breadth of compatibility and functionality provided by the RT-AC3200, paired with its active hazard reduction, courtesy of ASUS' AiProtection feature; the RT-AC3200 router is ready to support the challenges and demands of your highly populated network and associated network traffic.

$329 | WWW.KOGAN.COM.AU

Kogan Atlas X1510

You won't need a map to find the value in this budget laptop.

The Atlas X1510 is a very plain-looking laptop, unadorned and without any conspicuous design flourishes, with only a Kogan badge stencilled on the lid and under the screen. The unit's plastic chassis has a good feel to it, but rings a little hollow when tapped. Its keyboard is functional, but could use a little more height and spring to the keys. Its 15.6-inch, 1,366 x 768-pixel display gets the job done, but its lowish contrast crushes light colours together and therefore loses some fine detail – and it has a very definitive comfort zone in terms of viewing angle, needing to be tilted just-so to avoid washing out. The built in 0.3MP webcam is... well, it's a webcam all right, but one that, even in good light, tends to have such poor contrast that it makes your eyes and mouth look like dense, black featureless holes. It's a little bit creepy.

Yet despite all those gripes, it's honestly hard to complain about this super-cheap $329 laptop from Aussie online retailer Kogan. It checks all the boxes in terms of basic features, with a quad-core Intel Pentium N3540 processor, 4GB of RAM and a 500GB hard drive, all running Windows 8.1 with Bing. The latter's a virtually-free (depending on who you ask) version of Microsoft's OS – and it helps explain one way Kogan's managed to shave down the price so low on this machine. Windows 8.1 with Bing is, however, functionally identical to the regular version, the only caveat being that laptop makers must leave Microsoft's Bing configured as the default search engine. As the consumer, though, you can always change this after purchase – to Google, Yahoo or anything you want.

All that adds up to a laptop that's perfectly adequate for any normal day-to-day task barring hardcore gaming, be that surfing the internet, word processing, streaming videos or editing the occasional photo. It won't win any awards for speed – some applications take a good 20-30 seconds to load, and if you're looking for a laptop to re-encode movies to watch on your smartphone or tablet, we'd definitely consider spruiking for something with more grunt.

Even the comparatively small battery doesn't actually disappoint. It's only three cells, but as the Pentium processor driving the show's not particularly power-hungry, that's enough to keep the whole system running for around 5-6 hours between charges. And that battery's also removable, meaning that when it eventually dies you'll be able to swap it out for a new one without the hassle of returning the whole laptop to Kogan.

It's even well stocked with inputs and outputs, with 802.11ac Wi-Fi, HDMI and VGA video outputs, four USB ports (one of which is USB 3.0), 100Mbps Ethernet, 3.5mm audio in and out and even an SD card slot.

In short, provided you go in with suitably-tempered expectations, the Atlas X1510 is a surprisingly good-value budget laptop – and one that punches well, well above its $329 price tag. ■ **Dan Gardiner**

Verdict

Features	★★★★★
Performance	★★★★½
Value	★★★★★

It's basic and plain, but Kogan's budget laptop does everything you need at a very keen price.

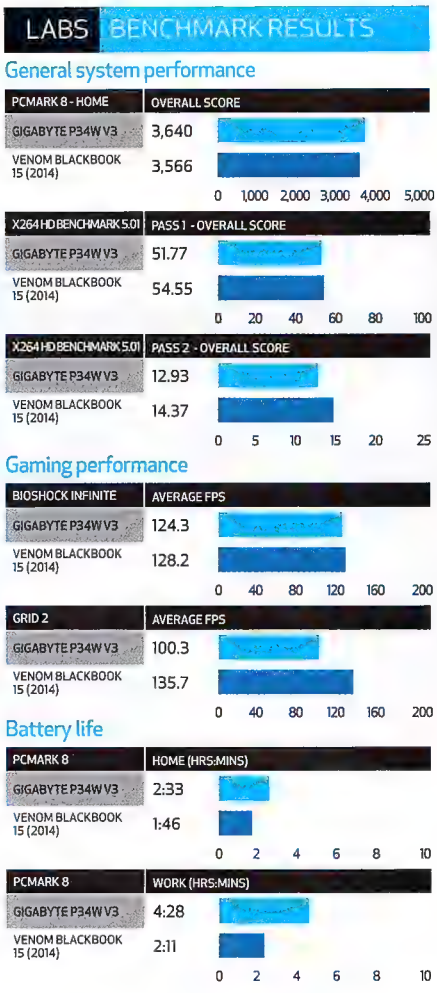
★★★★★

PERFORMANCE LAPTOP

FROM $2,399 | WWW.GIGABYTE.COM.AU

Gigabyte P34W v3

Gigabyte takes another stab at building a compact laptop that's also a powerhouse.



Gigabyte's built up a reputation over the last couple of years for pushing the boundaries of laptop design, squeezing high-end components into a slim and (comparatively) light chassis. The P34W v3 is the successor to last year's P34W v2, and like the latter it offers sedate, workplace-friendly looks in a slightly unconventional 14-inch size. Packing a 1080p display with a near-top Core i7-4720HQ processor, 16GB of RAM, Nvidia GeForce GTX 970M graphics chip and combo storage of 128GB SSD and 2TB hard drive. (Locally, paying an extra $100 will net you a 256GB SSD – something we'd definitely recommend.)

And in terms of physical design, this is a classy job – with a smooth and curvy aluminium-and-plastic chassis (keyboard deck and lid are aluminium, while the screen surround and underside are plastic), a backlit chiclet keyboard that's a step above last years (with keys that are raised higher and a bit more resistant) plus four USB 3.0 ports, HDMI out, Gigabit Ethernet and more. The v3 is a little heavier to pick up than it looks, but still portable at 1.82kg. Taking the rather mammoth charger along too, however, will add another 650g.

You might not need the that charger though, the battery life was better than we expected from a machine with these specs. While it's still a lowish 2:33hr when pushed, with less-demanding workloads that can stretch an extra 2 hours, giving you half a day's work.

When stressed though, despite its small size the P34W v3 can deliver a heap of power for basically any task – be that re-encoding videos, playing the latest AAA games, or chatting via video across the web.

As we saw with the Aorus X7 Pro last month, the other caveat for sandwiching such powerful hardware into such a slim body is fan noise. Unlike bigger laptops, which can use more metal heatpipes and grills to help spread out and dissipate heat, the only option for a thin machine like this is to ramp up the exhaust fans.

While sitting idle and doing light desktop work, those internal fans are usually quite discrete. But fire up a demanding recent-release game and that GPU can warm up to a balmy 87°C – and in compensation, the fans will kick up to a very high speed. While this isn't quite the hair-dryer that the SLI-equipped Aorus X7 Pro was, it does still get loud. You – and everyone within five or six metres – will know when the graphics chip is being stressed.

That heat issue also has an impact on performance. Compare the frame rates here to the Venom BlackBook 15 we reviewed last month (which also uses a GTX 970M) and you'll see a drop, often by over 15%, that's caused by heat-based GPU throttling. Thankfully, the GPU is powerful enough that it can afford to throw that performance away and still produce smooth frame rates.

Overall then, while the P34W v3 does a better job of squeezing high-end parts into a small chassis than many others, it's important to realise there are still drawbacks to this approach. We're not quite at the point where you can have your cake, so to speak – but we are inching closer. We're looking forward to seeing next year's v4, but in the meantime, the v3 gets the job done. ■ **Dan Gardiner**

Verdict

Features	★★★★½
Performance	★★★★
Value	★★★★

High gaming temps and a large charger mean this one's not perfect, but it's still a compellingly fast and compact laptop.

★★★★☆

"In this context, suddenly the FX-8320E looks like a more intriguing purchase. That's especially true if you're sitting on a lower core-count AM3+ chip and looking to upgrade."

CPU

$235 | WWW.AMD.COM

AMD FX-8320E

A budget octo-core CPU, but is it cheap enough?

AMD actually released this chip late last year, along with the FX-8370E as a pair of lower-powered octo-core CPUs for the more power-conscious consumer. These two chips use AMD's Bulldozer processor tech and squeeze into a 95W TDP. They do this by using a lower base clock, retaining the same Turbo clock as their non-E brethren. To that end, this FX-8320E is running at 3.2GHz as standard, with the ability to hit 4GHz as needed. The FX-8320's clock sits some 300MHz higher at 3.5GHz.

So far, so good. For 30W less power you only sacrifice 300MHz of CPU horsepower, which seems like a pretty good trade-off. But the fact these CPUs are still running with an outdated version of the Bulldozer architecture makes them seem more like an afterthought. In the Kaveri APU, launched a year ago, AMD used the latest revision of Bulldozer, codenamed Steamroller. Its next APU, Carrizo, will use the final Bulldozer revision, codenamed Excavator. This 95W chip then, using the old Piledriver architecture, is two generations behind AMD's top x86 CPU cores. And it doesn't look like it has any interest at all in shifting the FX range over to the Excavator design.

What's the game with the FX-8320E then? You'd assume that with the focus on hitting a lower TDP, this chip would be looking at small form factor machines, but that 95W TDP is still higher than the 84W Haswell Core i5 CPUs, even the K versions. But then there's the price. At $235, this is the cheapest eight-core CPU around.

In this context, suddenly the FX-8320E looks like a more intriguing purchase. That's especially true if you're sitting on a lower core-count AM3+ chip and feel the need for an upgrade. In performance terms – in both straight CPU and gaming tests – the FX-8320E is evidently behind both the FX-8350 and Intel Core i5-4570, but it's a good $60-100 cheaper than those more powerful chips. And because it's an unlocked AMD chip you can get happy with the overclocking, should your chosen chip and board be capable.

Our sample wasn't very happy running anything above 4GHz. We got a little more out of it with some voltage tweaks, but not enough to keep it stable on the 970 chipset board we were testing it in. Still, at that speed on all cores it runs mighty close to a stock-clocked, full-fat FX-8350.

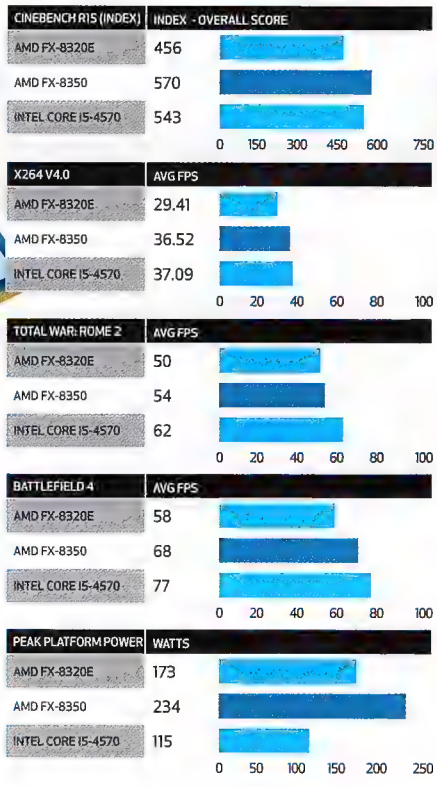
For the AMD upgrader then, it's not a bad budget option. If you're looking to build an all-new machine though we'd still struggle to recommend an AMD setup. Even though you're getting eight threads of processing power, a resolutely quad-core, unoverclockable Core i5-4570 will still deliver better CPU performance, and in a smaller power envelope too. The Intel platform is also more up to date and not much more expensive either. While AMD's AM3+ chipsets were queuing up for their pensions, Intel's latest were busy fitting themselves out with native USB 3.0 and PCIe 3.0 support...

And then there's gaming. If you're a PC gamer, your AMD CPU is stealing frames from your GPU. The difference between the Core i5-4570 and this FX chip is nearly 20fps on average at 1080p settings with the same GPU. And that's with a 50W peak platform power saving over the AMD offering too. Yes, it's initially a cheaper option, but you're paying a different price going the AMD route. ■

Dave James

LABS BENCHMARK RESULTS

The AMD tests were done at stock speeds on an MSI 970 Gaming motherboard, with 8GB RAM @ 1,600MHz on Windows 8.1 64-bit. The Intel tests were done on an ASUS Maximus VI Hero motherboard with 8GB RAM @ 1,600MHz on Windows 8.1 64-bit. The gaming tests all used a stock GTX 780 Ti running at top settings with 4x AA and at 1080p.



Verdict

Features	★★★
Performance	★★★
Value	★★★½

A decent upgrade for an AMD setup; relatively cheap.

★★★

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http://www.gigabyte.com/

"Running games at full resolution produced fantastic colours, with a sharp picture and oodles of detail — but it just wasn't as smooth as we'd want playing at 30Hz"

MONITOR

$620 | VIEWSONIC.COM.AU

ViewSonic VX2880ml

An attractive, affordable 4K monitor.

4K monitors are available in all shapes and sizes, but none looks quite like the 28-inch VX2880ml. It's distinctive, for sure, thanks to a two-part stand that makes it look like it's rearing up on its hind legs. ViewSonic recently said that it wanted to "bring 4K to the mainstream" with the VX2880ml, which is keenly priced at $620, and you can find it for less on various online retailers' web sites.

Set up isn't difficult, but it's not quick either. Once put together, the monitor feels fairly sturdy, though the stand's three-pronged design makes it susceptible to being knocked over from either side. There's also no way of adjusting height, nor can it pivot up and down or be rotated from side-to-side either.

The VX2880ml's connections, located on a rear lip, aren't the most accessible because they point downwards. The advantage of this is that the VX2880ml can be easily wall-mounted using a four-bolt VESA mount. Around the back is a DisplayPort, mini DisplayPort and HDMI 1.4. All three ports can be used to drive the monitor set to its native 3,840 x 2,160 pixel resolution. There's also an MHL-HDMI port for connecting Android devices. There's also speakers, though they're poor.

The VX2880ml's menus are operated using touch-sensitive buttons located below the monitor's bezel. One toggles the on-screen menu, while the other goes through the various menus and input sources. They don't beat tactile buttons, but they're functional and let you quickly cycle through the options.

The VX2880ml uses a TN panel, rather than IPS, and its viewing angles are slightly narrower as a result. Image quality is excellent, producing images that are sharp with bold colours and inky blacks. Viewsonic has aimed to make the monitor one of the most affordable in its class, so at its maximum resolution the refresh rate is only 30Hz, rather than the conventional 60Hz – which means when using the desktop or playing games, there's a tendency for ghosting, which makes cursor trails visible and operation juddery. The VX2880ml supports DisplayPort 1.2 in its settings, but selecting it doesn't make any difference to the 30Hz.

It's a shame ViewSonic didn't go for 60Hz, as picture quality is impressive. Running games at full resolution produced fantastic colours, with a sharp picture and oodles of detail – but it just wasn't as smooth as we'd want playing at 30Hz. Lowering the resolution to 2,560 x 1,440 or 1,920 x 1,080 brings the refresh rate back up to 60Hz, giving us the extra smoothness we wanted. Of course, that renders buying a 4K monitor somewhat pointless unless you're prepared to switch resolutions depending on what you're using for that minute – hardly ideal.

The bottom line? The VX2880ml's 30Hz refresh rate limitation makes it unsuitable for gaming or doing work in 4K. If you're after something for viewing 4K video, however, it's affordably priced and smartly designed. ■ Kane Fulton

Verdict

Features	★★★½☆
Performance	★★★½☆
Value	★★★★½

Great quality at a reasonable price, it's a shame it's limited to 30Hz at 4K though.

★★★½☆

"It's worth noting the unit is not a NAS — it's dedicated to backups only and you can't use it as traditional network storage."

NETWORK BACKUP DEVICE

$590 FOR 2TB | WWW.BACKUPBOXX.COM.AU

BackupBoxx

A new Aussie take on network data safety.

Unlike a traditional NAS, the BackupBoxx is a mini PC that connects external USB drives to your network. The hardware used is the CuBox-i – a cool little all-in-one PC that runs a ARM Cortex A9 processor and measures about 5cm square. It has two USB 2.0 ports that can handle external drives as well as Gigabit Ethernet and 802.11n Wi-Fi. The unit comes pre-configured, so all you need to do is plug it in, connect it to your network and install the client software on each PC you want backed up.

With that done, it will then make a full backup image of your entire drive as an easily restored VHD file. Unlike a NAS, the BackupBoxx includes a back to base monitoring service (and tech support) that's free for the first 60 days, and then costs $300 a year. If you miss a backup, you get an email reminder, followed by a phone call to check what has happened. The unit and drive will set you back $590 for 2TB (as tested), $740 for 4TB and $1,990 for 16TB (spread over four drives).

In principle, the idea is solid, but the implementation lacks polish. Setup is relatively straightforward, letting you get backups happening with minimal fuss. It's worth noting the unit is not a NAS – it's dedicated to backups only and you can't use it as traditional network storage. While this limits the functionality, it does add another layer of safety – you can't delete any files by accident. Essentially the BackupBoxx is meant to work alongside your existing NAS, physical media and cloud backups for total data security. The drive is connected via USB 2.0, slowing transfer rates – we got 8.41 / 7.58MB/s read/write speeds. In comparison, an affordable yet quality two-bay NAS with dual 2TB HDDs will cost less, give faster transfer speeds, can also send automatic emails with reports about your data backup status and offers heaps of extra features, such as mobile integration via apps.

If you want to get hands on, BackupBoxx includes a manual and it's pretty easy to change the configuration. The default backup is set for every 4 hours, but if you want higher (or lower) protection, you can adjust this time period. You can also exclude certain files or directories from your backups, such as music or videos. If your drive runs out of space, older backups are automatically deleted, though these can be archived and stored long term.

You can totally customise the BackupBoxx email settings, including removing the copies sent to BackupBoxx. Of course that means that they can't monitor your backups, which kind of defeats the purpose.

At the end of the day the BackupBoxx is a relatively easy way to ensure automatic backups, but it doesn't do much a NAS can't. It's certainly got appeal to a niche market – it's preconfigured, has Australian tech support and independent monitoring. Ultimately though these days NAS setup is so easy, it's hard to recommend BackupBoxx unless you really need the exact feature set.

Lindsay Handmer

Verdict

Features	★★★½
Performance	★★★
Value	★★★

A unique feature set that ultimately struggles to appeal over an affordable NAS box.

★★★☆☆

USB SOUND CARD

$300 | AU.CREATIVE.COM

Creative Sound Blaster E5

Sounds like super-versatile audio fun to us...

The words 'Sound' and 'Blaster' are as indelibly etched into our old-school PC gaming psyche as 'autoexec.bat' and 'config.sys'. We spent unknowable hours configuring DOS-based games to make sure we got compatible audio out of them. Sound Blaster basically became synonymous with PC gaming audio right from the outset.

And then onboard motherboard sound got good enough that we stopped buying discrete soundcards, plus USB headsets now bypass them both. Chances are then that you don't have a Sound Blaster in your PC any more.

And that's a shame because Creative still make outstanding PC audio devices and this USB-based portable headphone amp is testament to that fact. The Sound Blaster E5 is an HDD caddy-sized lump of audio loveliness, packing the excellent SB-Axx1 audio processor and a hi-res digital to analogue converter (DAC) into its unassuming package. That sound silicon is the same as in Creative's Sound Blaster EVO headsets and with the controller software you can tweak away to your heart's content. From the equaliser to the Crystaliser, you can tailor the audio to suit whatever you're doing with your machine at that moment. Want super-clear dialogue? Tweak this. Want eardrum-shattering bass? Go ahead, tweak that.

At $300 it's a lot of money to spend on your PC's audio, especially considering you can pick up a decent ASUS Xonar or Creative Sound Blaster PCIe soundcard for less than half the price. But bear in mind that this thing is seriously powerful and a hell of a lot more versatile than a single slab of audiophile PCB.

AUDIO ALL-STAR

Sat on your desktop though you can have it USB'd into your machine, cleaning up the audio and boosting it with Creative's years of audio processing know-how. The comprehensive software controller suite is excellent and easy to use and with a good set of analogue headphones attached you can really hear the improved aural quality the E5 provides. And that's where this Sound Blaster is at its best, when it's attached to some quality cans.

The Bluetooth NFC-able connectivity means you can wirelessly connect to your phone while it's running your PC's audio. So if you don't want to miss an important call, or you're happy chatting to your mum via your headset while you gad about the galaxy in your souped-up Sidewinder, it'll work seamlessly.

It doesn't necessarily need to be plugged into your PC either. There are Android and iOS apps available for it, and the 3,200mAh battery will keep it going for hours. And, if you're into sharing, there's a pair of headphone outputs to share an audio stream between a couple of connected cans. See, versatile, innit?

But you do have to really care about your audio to spend the big bucks on it. And if you don't have a decent non-USB headset you're not going to get the full audiophile benefits of the SB-Axx1 processor. But the Sound Blaster E5 is a neat, compact and versatile mini amp that defies its scale with some seriously big sound.

Dave James

Verdict

Features	★★★★½
Performance	★★★★
Value	★★★

Compact; well-built; great sound; good software; incredibly versatile. Seriously pricey.

★★★★☆

GAMING MOUSE

$80 | WWW.ASUS.COM/AU

ASUS Strix Claw

This is no optical illusion.

The STRIX Claw gaming mouse that uses an optical sensor as opposed to a laser one. That means it can be far more sensitive to the surface it's operating on and while that downside might put you off an optical rodent, there are some definite benefits to the optical sensor.

One of the reasons you get some pro-gamers preferring optical sensors is that they don't use any hardware acceleration, which can cause inconsistencies when moving at high speeds. With the optical sensor working on a 1:1 basis you get consistent tracking. At top speed (5,000dpi) the Claw is responsive and accurate in-game and has four DPI settings you can flit between at will. There's also a DPI Clutch button sitting just below the forward/back buttons by your thumb. You can use this to instantly drop the DPI to a super-low setting to aid in your sniping activities while you're holding the thumb button down. Physically we're big fans of the STRIX Claw too. The ergonomic design is right-handed only, but it's a comfortable fit for either the titular claw-grip player or palm-grippers. It also feels nicely chunky in-hand despite being very lightweight, which allows it to glide across your mat with ease. Our one real concern with the Claw is the software, which can be flaky in operation when tweaking lights. That slight issue aside, the Claw is an excellent optical gaming mouse. We're still variously Logitech and Razer lovers on the laser side, but the Claw is starting to turn our heads towards the optical side. ■ **Dave James**

Verdict

Responsive and accurate, comfortable design, good-value for functionality. Weak software.

★★★★☆

PC SOUNDBAR SPEAKER

$229 | WWW.RAZERZONE.COM

Razer Leviathan

It may be a comparatively little leviathan, but its bite is monstrous.

On the side of the box, Razor makes the pretty ballsy claim that the Leviathan is the 'One Sound Bar to Rule Them All' and – somewhat surprisingly – this relatively compact unit largely lives up to that bit of cheeky braggery.

At 50cm long and 10cm high, the Leviathan is on the small side for a soundbar, although when paired with its included downward-firing subwoofer (at 25 x 25 x 20cm cube) that size doesn't seem to matter at all, because the audio output is staggeringly huge. The Leviathan can, frankly, get obnoxiously loud – and it does so while maintaining bounce, clean bass, warm, filling mids and (when equalised properly) sharp, clear highs without any sign of clipping. Vocals are nice and clear, while booming explosions are pleasingly impactful. Be warned, however, that these can take a bit of equaliser tweaking to get sounding perfect – we got the best results from choosing the Gaming preset (there's also Music and Movies) and then jacking up the treble on our output device. There's a very handy feature in Bluetooth 4.0 connectivity with NFC pairing, plus 3.5mm analog and optical audio inputs for hooking up other equipment. What these perhaps aren't great for is PC audio. There's a definite sweet spot in terms of audio output from the soundbar – and sitting at a desk a couple of feet in front of it isn't it. That, and the big sound overall, make the Leviathan more suitable for using in the lounge room with a console (or just plugging it into the back of your TV via optical out) than with your desktop PC gaming rig. ■ **Dan Gardiner**

Verdict

It may be small in stature, but this is a fantastic little soundbar that can produce a massive sound.

★★★★½

PC CASE

$130 | WWW.THERMALTAKE.COM.AU

Thermaltake Core X1

A new approach to custom PC builds.

The Core X1 is not your run of the mill mini-ITX case – it has a very unique stackable modular design. For example, with two or more Core X1s on top of each other, one could contain your hardware and the other your high end liquid cooling setup. You don't just plumb from one case to the next either – side, top, bottom and front panels, as well as motherboard tray and other mounts are totally removable, so you can create a custom chambered setup that acts as a single case. You also get a windowed side panel that can be installed left or right, numerous removable magnetic dust screens and more fan / radiator expansion options than you can count. The power/reset panel has dual USB 3.0 and 3.5mm audio, and can also be swapped to either side of the case.

With everything in place, you can fit a triple slot GPU, 3x 3.5 or 2.5-inch HDDs (+1 extra 2.5-inch), a 220mm PSU, a tall 200mm CPU cooler and if you ditch the dual 5.25-inch optical bay, a 400mm GPU (280mm with drive rack).

The modular design is amazing for custom PC builders, but for frequent lanners, the steel case is a touch heavy, a little angular and has few good lifting points. The X1 is also quite large (albeit roomy) for a mini ITX case at 426 x 280 x 471 mm.

The Core series is also available as a larger Micro ATX Core X2 and an E-ATX Core X9, for $175 and $219 respectively.

■ Lindsay Handmer

Verdict

A very versatile case that will be well received by custom PC builders.

★★★★☆

PC CASE

$TBA | WWW.FRACTAL-DESIGN.COM

Fractal Design Core 2300

The Swedes' latest is compact but capable.

The Core 2300 is a compact midi-tower case which, despite its smallish size and even smaller price tag, can support an impressive seven fans or three water cooling radiators, but it's the unique drive mounting that's most head-turning.

The drive bracket is a flat plate of metal which sits vertically in the case attached to the bottom of the 5.25-inch drive bay with two thumbscrews. It's been carefully designed so that it can hold both 3.5-inch and 2.5-inch drives at the same time. The drives are fitted vertically and up to three drives of each size can be used. The mounts even have vibration-damping rubber grommets. If you're only using a single solid-state drive then there's a single mount at the base of the motherboard plate so you could get rid of this bracket entirely if you wanted some extra aid in cooling. Cooling-wise the case comes with two pre-installed Fractal Design silent (1,200rpm) fans, one in the front and one in the rear panel. It can also support up to three liquid radiators, in the top, front and rear

The drive-mounting method also means you can fit graphics cards up to 380mm in length without the need to remove drive cards. The only annoying aspect of the drive bracket is the positioning of the bottom thumbscrew underneath the case. And, because of the 2300's compact nature, another problem is running cables behind the motherboard tray.

Unless you happen to be using a PSU with super-thin braided cables, there's very little room to play with. Cable-tidying obsessives are going to struggle to scratch that itch... ■ Simon Crisp

Verdict

Cheap; well-built; plenty of space for air and/or liquid coolers. Lack of space for cabling.

★★★★☆

apc RECOMMENDS

HOME THEATRE PROJECTOR

$1,249 | WWW.BENQ.COM

BenQ W1070+

A budget beamer you can't afford... to ignore

Not too long ago, a projector of any kind was a luxury most of us could ill afford. And even if we could afford it, we couldn't really justify it. If that's roughly where your thinking still is with projectors, may we suggest you take a quick look at the BenQ W1070+. It'll throttle such misconceptions with the nearest HDMI cable. It really is awfully impressive and utterly cinematic, especially for the money.

Right out of the box this thing is spectacular. The default settings are bang on the money, which we think is important for a projector at this end of the market, often bought by first timers looking at home cinema. The image is bright and oh-so-clean. Focus across the image is flawless and the black levels are as good as you'd hope for a DLP effort rated at 10,000 to one for static contrast. OK, there actually are projectors with even better blacks, but not at this price. The W1070+ nails darker tones as well as a projector costing thousands of pounds from just a few years ago.

Both the black and white scales are hard to argue with at default settings too, with little to no evidence of compression. Yippee. Overall, it's just one hell of a punchy, vibrant, full-1080p projector. And did we mention how affordable it is?

While we're singing the W1070+'s praises, the optional wireless HDMI kit is nice, too. It's based on adaptor boxes at both the source and receiver end of the equation, which is handy if you want to use it part time with a different display of some type. It also comes with a nifty little remote control for switching sources. Nice. The whole shebang is 3D-ready as well, though doesn't come with glasses in the price. But then there's only so much you can expect for the money.

If that's a healthy retinue of reasons why the W1070+ is a winner, here come some areas where it's not so wonderful. For starters, it's all built into a small, cheap box. That may be handy for tight spaces, but it certainly makes for a rowdy little projector in terms of noise. You're also not going to get decent optics in this class of device. OK, the geometry is actually spot on. But there's no lens shift, so positioning is key to achieving a good image. As it happens, that's not necessarily going to be easy given yet another drawback of the cheap optics, namely a limited zoom range. It means you have to position the projector in quite a specific location to achieve a given size and location of image. Flexible the W1070+ most certainly is not.

Like pretty much any DLP at this end of the market, the dreaded rainbow effect makes an appearance here. As ever, it's one of those things that some notice more than others. If it's a major issue for you, the W1070+ may not be the best choice.

That said, we're willing to forgive the W1070+ quite a lot given its tempting price point. It would simply be unrealistic to expect a full-feature, 1080p DLP beamer in a box big enough for near-silent cooling and complete with lens shift and wide-range zoom. But what you do get is seriously snazzy image quality that will blow any HDTV clean out of your living room. Even at this low price, we'll happily admit that a projector isn't going to be an automatic purchase, but it is one we think you can't afford to not even try. And this BenQ wouldn't be a bad place to start experimenting at all.

Jeremy Laird

Verdict

Features	★★★½
Performance	★★★★
Value	★★★★½

Affordable for a decent 1080p DLP projector; zingy image quality; lots of features. Noisy fan; cheap optics.

★★★★½

HOME THEATRE PROJECTOR

$2,395 | WWW.EPSON.COM.AU

Epson EH-TW6600W

The LCD alternative to DLP dominance is still alive.

Ignorance, they say, is bliss. We don't know for sure about that, but just occasionally it can certainly come in handy for reviewing products. Like this Epson projector for one.

When we first fired it up, it looked pretty nice. Except the black levels weren't quite what we're used to with the latest DLP beamers. And that was when we remembered. Epsom only does LCD projectors. Ah. Of course. Had we known from the get-go, we'd have already been expecting mediocre black levels. .

The Epson EH-TW6600W is a full-on movie projector rather than an all-rounder. That means it's a bit pricier than your typical all-purpose beamer. In return, you get a large chassis that allows for a bigger and therefore quieter fan. This thing makes very little noise.

You also get proper optics. By that we mean firstly a setup that maintains focus when you adjust the size of the image. Secondly, there's significant lens shift available. In other words, you can adjust the trajectory of the image with the lens rather than ratcheting up and down some shonky legs. Finally, there's a generous 1 to 1.6 zoom factor. That allows you to stick this thing in most rooms and achieve your desired image size.

Next up, there's wireless HDMI functionality. In this case, there's an adaptor for plugging into your source, or sources (it sports no fewer than four HDMI inputs). But the wireless receiver is integrated into the chassis. That's tidy, but it means you won't be able to use the wireless HDMI for other displays. As ever, your mileage will vary in terms of signal integrity. It may work room to room depending on wall thickness, but it's better as a line-of-sight connection. Anyway, the other major feature is active-shutter 3D support (including over the wireless HDMI connection) which you can take or leave. We'd mostly leave it, but for 3D fans it's nevertheless part of the package.

As for performance, let's get back to those blacks. While noticeably off the pace set by the latest DLP units, don't go thinking the TW6600W lacks contrast. It's a very plausible cinema projector. Notably, colours and especially skin tones are that little bit more natural than DLP technology, which looks spectacular, but can be a bit contrived and over-saturated.

On the downside, the default settings involve quite a bit of compression in both whites and blacks, so you'll need to manually tweak colours and contrast if accuracy gets your knickers in a twist. We also note that while achieving consistent focus across the image is easy enough, image geometry is a little off. The picture isn't quite perfectly rectangular. Nor is it blazingly bright, which isn't a surprise given the 2,500 lumens rating.

The final demerit regarding image quality involves some hideous digital pixel sharpening enabled by default. It can be disabled (though the setting is comprehensively buried in the OSD menu), but it's awful and shouldn't be on by default.

All of which makes this Epsom projector an acquired taste. We can understand how movie buffs who prize a natural cinematic image over visual pop could well favour the TW6600W. The wireless connectivity is a real boon for achieving a neat installation, too. But as an all-round proposition for games and daytime use along with movies in the evening, there are simply better, cheaper options.

Jeremy Laird

Verdict

Features	★★★½
Performance	★★★★
Value	★★★½

Lovely, natural colours; super optics; very quiet; easy wireless connectivity. Mediocre black levels; iffy geometry.

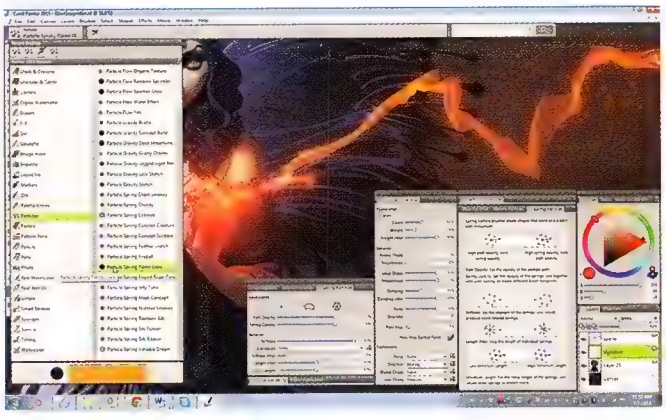
★★★½

software

» APPS FOR ALL THE PLATFORMS

Windows SOFTWARE

Corel Painter 2015



Corel adds a touch of psychedelia to its digital art program.

$429 | COREL | COREL.COM

Corel's Painter has long been a stalwart of digital painters, and it's still the single best program for media and brushes that act just like the real thing. Load a thick brush with a lump of acrylic and it'll gloop across the virtual canvas, watercolours smear and soak into the paper, and you can swipe over the lot with the palette knife.

The experience is so life-like it's perfect for artists who wish to ditch the easel and go digital – the only thing missing is the heady whiff of freshly opened oil paints – and when used with a Wacom tablet it gets even better. Corel has nailed its recreation of real-world tools, then, but this presents a quandary for the company, since there's no room for innovation, short of creating an entire new medium.

Corel's answer to this is to create new abstract brushes and media that could never exist in the real world. Named 'particle brushes', these consist of animated floating points which constantly expand and contract, dragging behind the cursor and flailing out when you bank around corners. They take some getting used to, but they can be used to create stunning effects such as dramatic lightning sparking across the canvas, or a subtle trail of smoke. They're definitely best when used as additional effects on top of art created using more traditional mediums, unless you want to create something really psychedelic.

Other new features include native 64-bit operation, jitter smoothing (which gives you more control over a brush's random fluctuations) and custom palette arrangements. There are also real-time previews of any effects you add, enhanced brush tracking so you can see how settings alter your strokes, and lots of new papers, patterns and gradients. It sounds a lot, but it doesn't actually add up to a huge amount, and if you've already got Painter, perhaps download the demo to see how much you use the added features.

Corel seems a bit behind Adobe when it comes to pricing. As much as Adobe's Creative Cloud has divided its key audience, there's no denying its Photographer package, which gives you the latest version of Photoshop for about $20 a month, is good value. Painter costs a whopping $429, and given Corel's release schedule, there'll be a new version in a year.

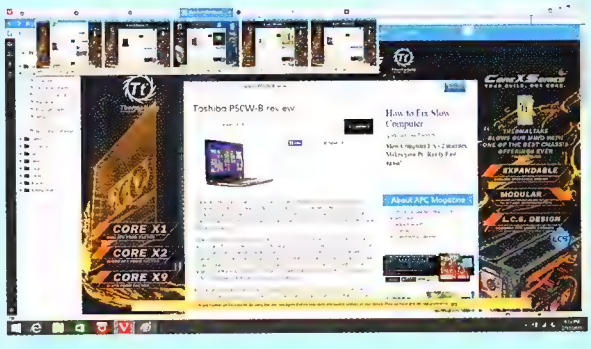
It's also hard to see where Painter's going to go next. Procreate and ArtRage offer similar functionality on iPads, and Flame Painter has added psychedelic effects on Macs, all for a fraction of Painter's asking price. The core painting experience is still better than these apps, but Corel's approach to pricing and distribution certainly needs an update.

Henry Winchester

Vivaldi

FREE | VIVALDI TECHNOLOGIES | WWW.VIVALDI.COM

Just when you thought the web browser wars were dead and buried, a couple of new contenders have popped up. Microsoft's ditching IE for Spartan and now a team of ex-Opera staffers is creating Vivaldi, pitching it as a browser specifically for power users. We tested the tech preview version and so far, we're actually impressed. One of Vivaldi's key features is tab stacking, which lets you group together tabs either automatically by domain, or manually by dragging the desired tabs on top of one another. It's a great way of uncluttering the browser's tab bar. And even with about 60 tabs open, Vivaldi wasn't a resource hog — chewing just a few percent of our CPU cycles. There's a Quick Commands bar down the left side of the main browser window, which can flick out a pane with your bookmarks, downloads and a handy integrated notes app that includes the ability to snap screenshots. And the interface is fast, as are web page loading times. Vivaldi still undoubtedly has a way to go — it'll need add-ons and extensions if it hopes to compete, and tab groups are a little slow to use; you've got to wait an agonising second or two for the nav preview window to pop up. Still, if none of the current browser options are doing it for you, this is definitely worth a peek. **Dan Gardiner**



Logic Pro X 10.1

Apple's pro-level music powerhouse embraces electronica, EDM and hip-hop.

$249.99 | APPLE | WWW.APPLE.COM/AU

Apple's professional music package is a familiar sight in commercial recording studios and on arena stages. It offers multi-track recording, great MIDI features, effortless loop-based music creation and stacks of virtual instruments. With the Logic Pro X release it gained tools for fixing timing and tuning, a vastly improved interface, better MIDI handling and the jaw-dropping Drummer, which produces incredibly realistic "live" drumming.

Drummer wasn't perfect though: in Logic Pro X the available drummers were fine if you wanted to make rock, folk, country or metal, but if you wanted to make dubstep, EDM or hip-hop you'd need to turn to your loop library or create the beats by hand. When even the most traditional musicians tend to have at least some electronic elements in their music, that was a major omission. With Logic Pro X 10.1, Apple has made the program more useful to electronic music makers, and it has also fixed some bugs and introduced some useful features for musicians and producers of all kinds in an update that's free to existing users.

The most obvious new feature is the addition of 10 new electronic and hip-hop drummers that make beat-making much easier. You can stick with the presets or fine-tune the drum machines via Drum Machine Designer, and the new Note Repeat and Spot Erase features make it much easier to edit MIDI drum patterns. Piano Roll has been tweaked to make it more drum-friendly, the new Brush Tool enables you to create a series of notes with mouse or trackpad gestures and the new Time Handle feature enables you to expand or compress MIDI, so for example you might take a pattern and slow it down without changing how it's played.

The 10.1 update isn't just for electronic and hip-hop afficionados, though. There are more than 200 new synth sounds and a new instrument, the Mellotron; there's a new Smart Quantize feature that can fix timing without removing deliberate flourishes such as piano figures or drum fills; you can automate regions instead of entire tracks and move the automation data when you move the region or regions; there's a redesigned Compressor plug-in; the Plug-In Manager is now customizable and there's support for AirDrop in Yosemite for sharing projects with other Macs.

Logic Pro X 10.1 is user-friendly enough that coming to it from Garageband is no longer terrifying, but behind the friendly face is a powerful pro-level digital audio workstation. And it's affordable. Where previous versions were among the most expensive music packages you could buy – in 2004, Logic Pro 6 was $999 – Logic Pro X 10.1 delivers incredible value for acoustic, electric and electronic artists alike.

Gary Marshall

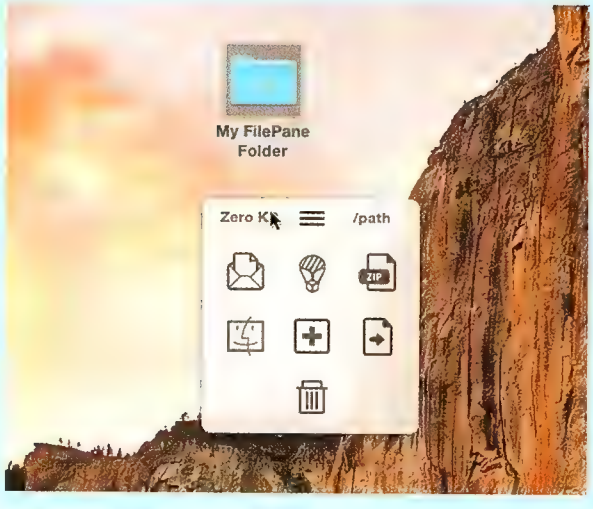
FilePane

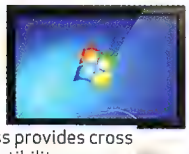
$6.99 | SERGII IAMKOVYI, | WWW.MYMIXAPPS.COM/FILEPANE

FilePane consolidates an assortment of file management features into a lightweight pop-up menu. FilePane lives in the menu bar, popping up a small "Drop Here" panel whenever the user begins to drag a file or text snippet. Drop it "there", and a compact panel of icons appears, each representing popular actions such as sending an email, setting an image as desktop wallpaper, creating a ZIP archive, or cropping/rotating images on the fly, with or without proportional resizing.

FilePane also comes in handy for displaying word and glyph count for word processing applications without such native functionality, like TextEdit. The window options adapt to the host software, although some applications aren't supported (most notably, Microsoft Word).

FilePane's icons take getting used to — it's not always clear what each does, which could be remedied with tooltips when the cursor hovers over each option. We also had occasional issues with desktop icons vanishing from the screen while being rearranged without invoking FilePane, even though files could still be viewed in a Finder window. **J.R. Bookwalter**





Access provides cross compatibility across a number of platforms.

kittybook

Parallels Access 2.5

Access your files from your smartphone with ease.

$24.99 | PARALLELS INC | WWW.PARALLELS.COM

The team behind Parallels Access are proud of the latest update to their remote desktop app, with good reason. Version 2.5 brings wider cross compatibility, – now allowing almost all Android devices running 4.0 or later – refreshed smartphone and iPad interfaces and restructured pricing.

Its latest offering also allows you to control remote computers through any HTML5 compatible browser – no software required. While the interface is quite laggy (when using HTML5) and doesn't support advanced options like dual-screen setups, we expect these issues to be addressed in future roll outs, which would make Access a remote desktop application to be reckoned with.

But for now, the real strength of Parallels Access lies in its smartphone and iPad apps. It's simple to pick the remote application or file you need by using the intuitive tiled-app interface, and you can either copy a file to your device or make quick changes on the go. Impressively, they've even made Microsoft Word easy to use on a 5-inch touchscreen.

A personal user account is $24.99 per year, and allows up to five pre-saved remote computer connections. **Liz Pulo**

Chrome Remote Desktop

FREE | GOOGLE, INC. | TINYURL.COM/07SKQ8L

After having been available for Android devices since mid last year, an iOS version of Google's Chrome Remote Desktop app has finally made its way over to the App Store.

Once you've installed an extension on your Chrome browser, you can remotely access your computer and control it from your iPhone or iPad. And, since the computer becomes attached to your Google account, you only have to login to your account from whichever device you own, enter your PIN and you're in.

The app is fast and responsive, with minimal lag and multiple control options, including a Touch Mode for full touch control, and a Trackpad Mode which lets you guide a mouse pointer around your desktop for more accurate screen navigation.

Quite frankly, Chrome Remote Desktop works just as well as most other paid remote access competitors, only with the benefits of a slick user interface, the convenience of being part of Google's ecosystem and the price point of 'completely free' to really drive the service home. **Stephen Lambrechts**

Outlook

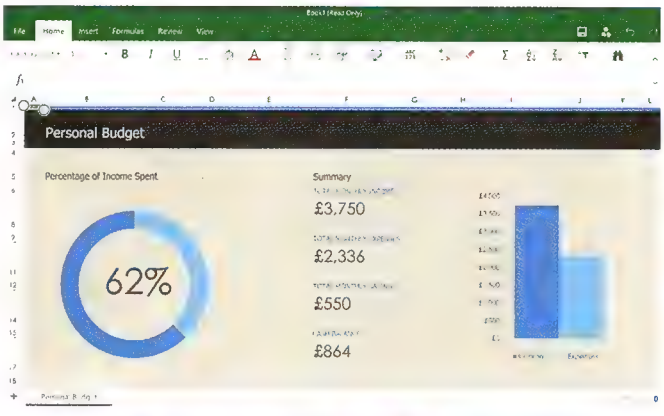
FREE | MICROSOFT CORPORATION | ACOMPLI.COM

Acompli is a clever mobile email app that was picked up by Microsoft in December last year, and it's since been integrated into the most-recent update for Outlook on Android and iOS. Acompli brings some interesting features to Outlook, the most obvious being that your inbox now doubles as a calendar. The Outlook app doesn't require a Microsoft email account either — it'll work equally with Exchange, Gmail, Outlook and Yahoo! Mail services. It even connects to a range of cloud suites that allow you to import calendars and files that you're likely to need when exchanging emails. This kind of interoperability isn't new in itself, but to be able to do all of it within one smartphone app gives you an amazing tool to simply and efficiently plough through work (or personal) emails, on the go. Its swipeable archiving and scheduling features can also make getting through, and taking action on, emails a quick, one-handed affair. With the ability to integrate with Dropbox, iCloud, OneDrive and Google cloud platforms the latest update of Outlook is a smartphone mail app that is definitely worth a try out. **Joel Burgess**

Microsoft Office for Android Tablets

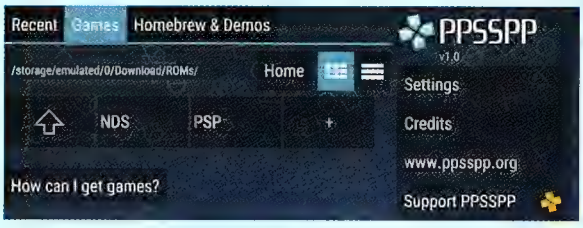
Android users rejoice – Office is now available... but only for your tablet.

FREE | MICROSOFT CORPORATION | TINYURL.COM/OCALHYY



It's been a long time coming, but Microsoft's main Office apps – Word, Excel and Powerpoint – are finally available on the Google Play Store for Android Tablets.

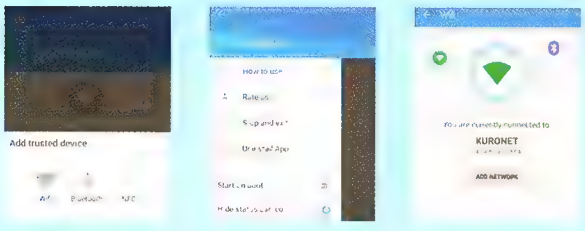
Tablet users now have access to Microsoft's suite of Office apps, and can use them to create and edit Word, Excel and Powerpoint documents that'll sync to their Dropbox or OneDrive accounts. The apps are free to download, but in this free form they'll only allow you to view your files. However, when linked to an Office 365 account, all of the features you know and depend on become unlocked. Designed with tablets in mind, the colourful interfaces for these three main apps all behave exactly like you'd expect them to, with intuitive touch controls that let you drag items around, pinch to zoom, and (our personal favourite) read your documents like an ebook. There is a downside. At present, the app will only work on 7-inch tablets or larger with ARM-based processors, at least a gig of RAM and the Android 4.4 (KitKat) OS. **Stephen Lambrechts**



PPSSPP

FREE; PREMIUM VERSION, US$5.99 | HENRIK RYDGÅRD
WWW.PPSSPP.ORG

The Android platform is no stranger to game-console emulators — you can get almost every platform from the 8-bit to 64-bit eras. One that was missing, until now, was an emulator for the Sony PlayStation portable. PPSSPP is a port of the popular open-source emulator for Windows, Mac and Linux, but despite being designed for those 'bigger' systems, in testing on a Galaxy Note 4 it ran without any performance problems, even in the most demanding 3D titles. Like other console emulators, PPSSPP works best with certain types of games — specifically, those that don't make heavy use of L and R shoulder buttons. These are tricky to replicate as on-screen buttons. Turn-based titles — like Japanese RPGs — fare a lot better. PSP ROMs are relatively easy to find online but be warned that they can be quite large (up to 1.4GB). This isn't the most full-featured or configurable of emulators, but it does get the basics done just fine. The free version is fully functional, but ad supported. **Dan Gardiner**



Smart Unlock

FREE 7-DAY TRIAL; US$2.49 | LOADING HOME
TINYURL.COM/APC413-SMRT

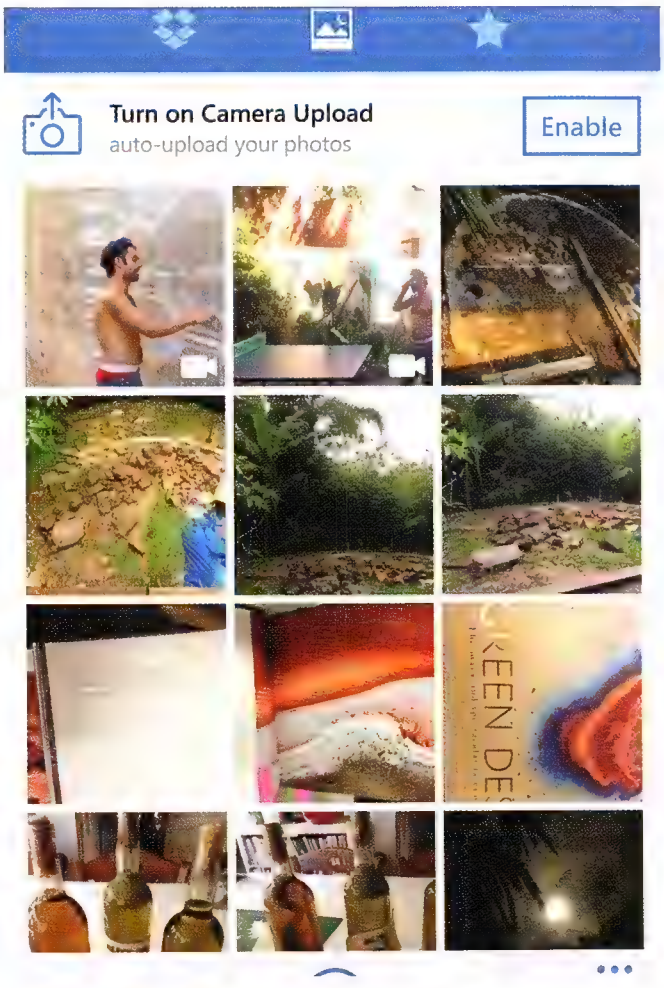
While it's common knowledge to have a passcode for your smartphone, it doesn't mean that it's not inconvenient, especially when you're entering your passcode countless times just to reply to a single message or email. In fact, the only time when a passcode is really necessary is when you're out and about in public places. Smart Unlock is an app that allows users to set up pre-determined 'safe' places where a passcode is not required, such as your home or office. Using either a Wi-Fi network or Bluetooth device (NFC and location-based triggers are coming soon) the app will automatically disable the passcode function on your phone, allowing instant access to your phone's home screen. Once you move away from your network or connected device, the lock screen will automatically be reinstated. The only catch is that the app won't work with most Samsung devices, as they use a modified lockscreen. **Tim Bothwell**

Dropbox

Cloud Heaven

FREE | DROPBOX INC. | TINYURL.COM/APC-413DBOX

Unless you're ensconced in Microsoft's cloud ecosystem – and are using the company's OneDrive online storage – attempting to transfer files from your Windows Phone to other devices has, up until now, been absurdly frustrating... and another recurring reminder of the 'dark age' that the platform's still (slowly) emerging from. With the long-overdue arrival of Dropbox to the platform, Windows Phones have taken one big step into the light – arguably right into cloud-storage heaven. For Dropbox fans (and there are many – at last count in mid-2014 it had over 300 million) the Windows Phone app makes transferring images and other files from your phone to a computer a relatively painless experience. It should be noted that this WP version isn't quite as full-featured as its iOS and Android equivalents. When uploading snaps, for example, you can only do one image at a time, which can be monotonous if you have numerous images... JB



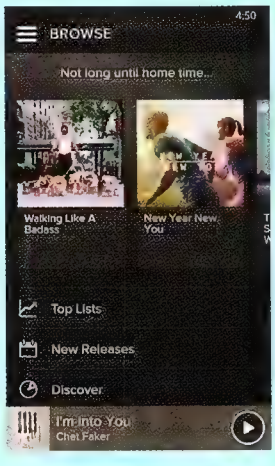
Office Lens

FREE | MICROSOFT | TINYURL.COM/APC413-OLENS

Office Lens is one of the most useful work apps on Windows Phone yet — it's basically like having a scanner in your pocket. Using your phone's camera, this app scans real-world documents and turns them directly into digital docs. With built-in OCR the app can pull out the words from a scanned image and shoot them over to Windows Phone's Powerpoint, Word and OneNote apps. Both the raw images and processed documents will upload to your OneDrive account, so they can be accessed immediately from any internet connected device. Downloading and using this app to scan a full page of text will be considerably faster than typing it out, and with the hefty price of 'free', if you're a Windows Phone owner it's hard to see why you wouldn't want to have this one in your pocket. That said, it has some limitations. The app has a specific setting for scanning business cards, but it still deals with scans in the exact same way as a document. It can't create contacts from a business card scan — something Evernote's excellent Scannable app on iOS can do. Still, with direct scanning to Word and Powerpoint, this is an incredibly powerful app that's absolutely worth downloading. JB

Spotify

FREE | SPOTIFY AB | TINYURL.COM/APC413-SPOTI



Spotify is a contemporary tool for finding and listening to music that allows users to listen to music they like in full and on demand before purchasing. With an enormous searchable library, internet radio stations and a browser page that will show you new, trending or a specific genres of music, Spotify is a great option that lets you quickly discover new music. It recently cracked the milestone of having over 60 million users connected to the free (or optionally subscription-based) music-streaming service. Set on continuing this expansion, the company's released a facelift for its Windows Phone app. The upgrade features a new, sleeker design that makes the platform feel and look like a premium smartphone app. Spotify on Windows Phone also now has a Your Music section (something Android and iOS users have had since 2013) that allows you to save the tracks you find on the site to folders and playlists in the app. Spotify is definitely one of the better-looking (and working) apps currently on the Windows Phone platform. **Joel Burgess**

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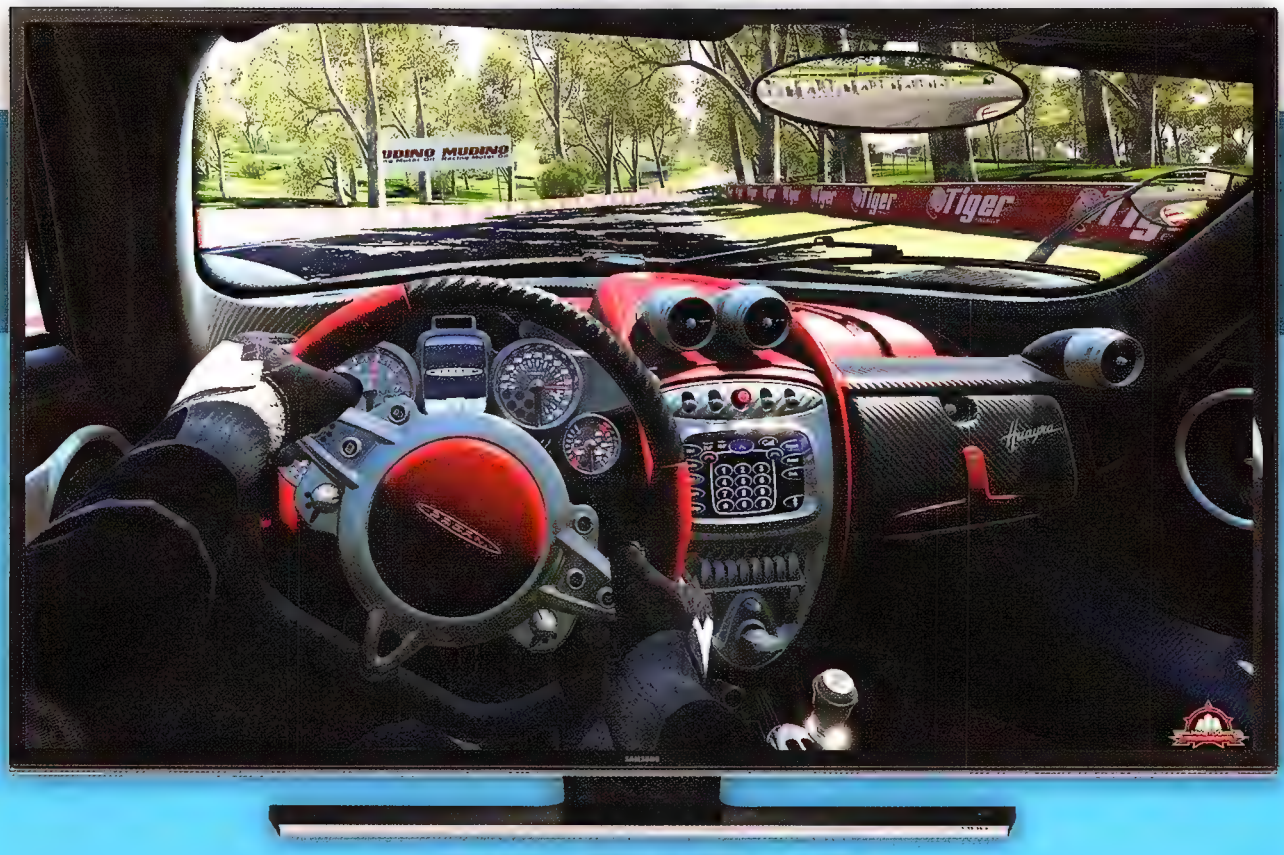
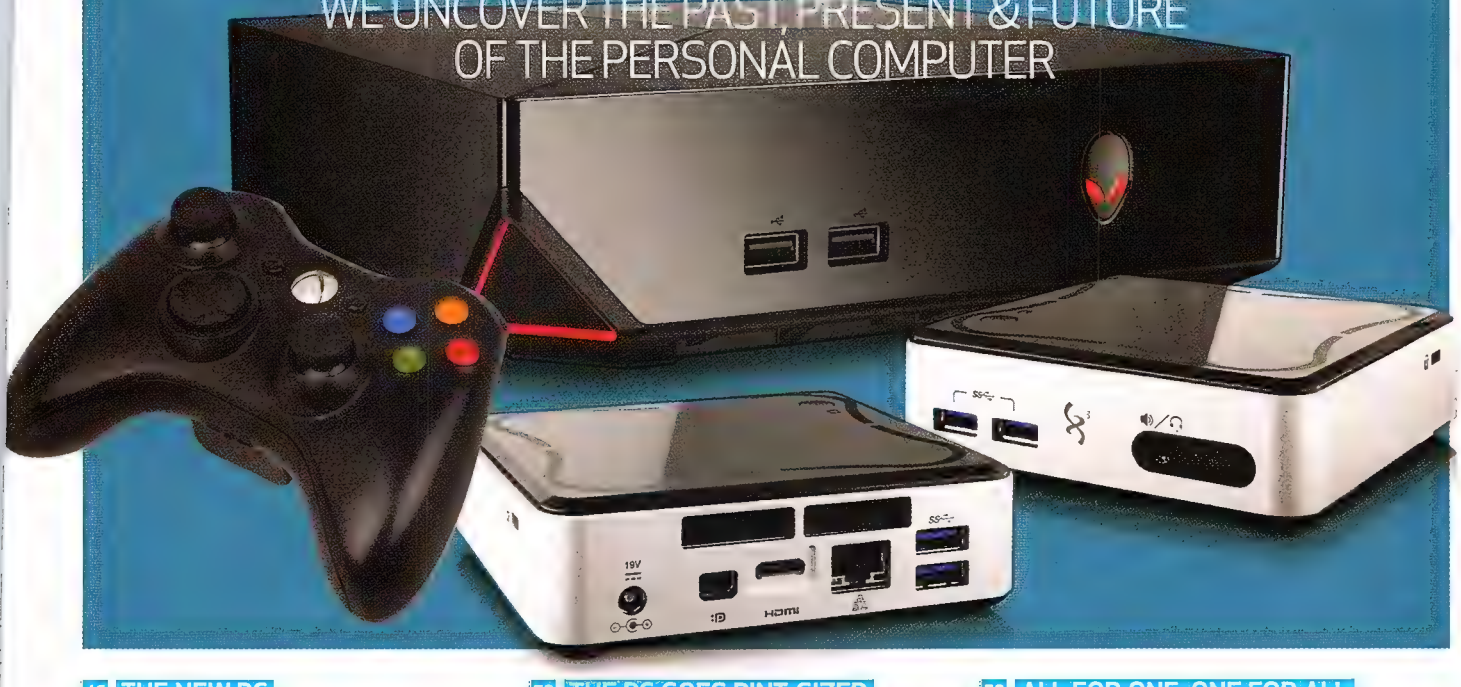


CHANGE IS IN THE AIR

THE NEW PC!

WHAT COMES NEXT?

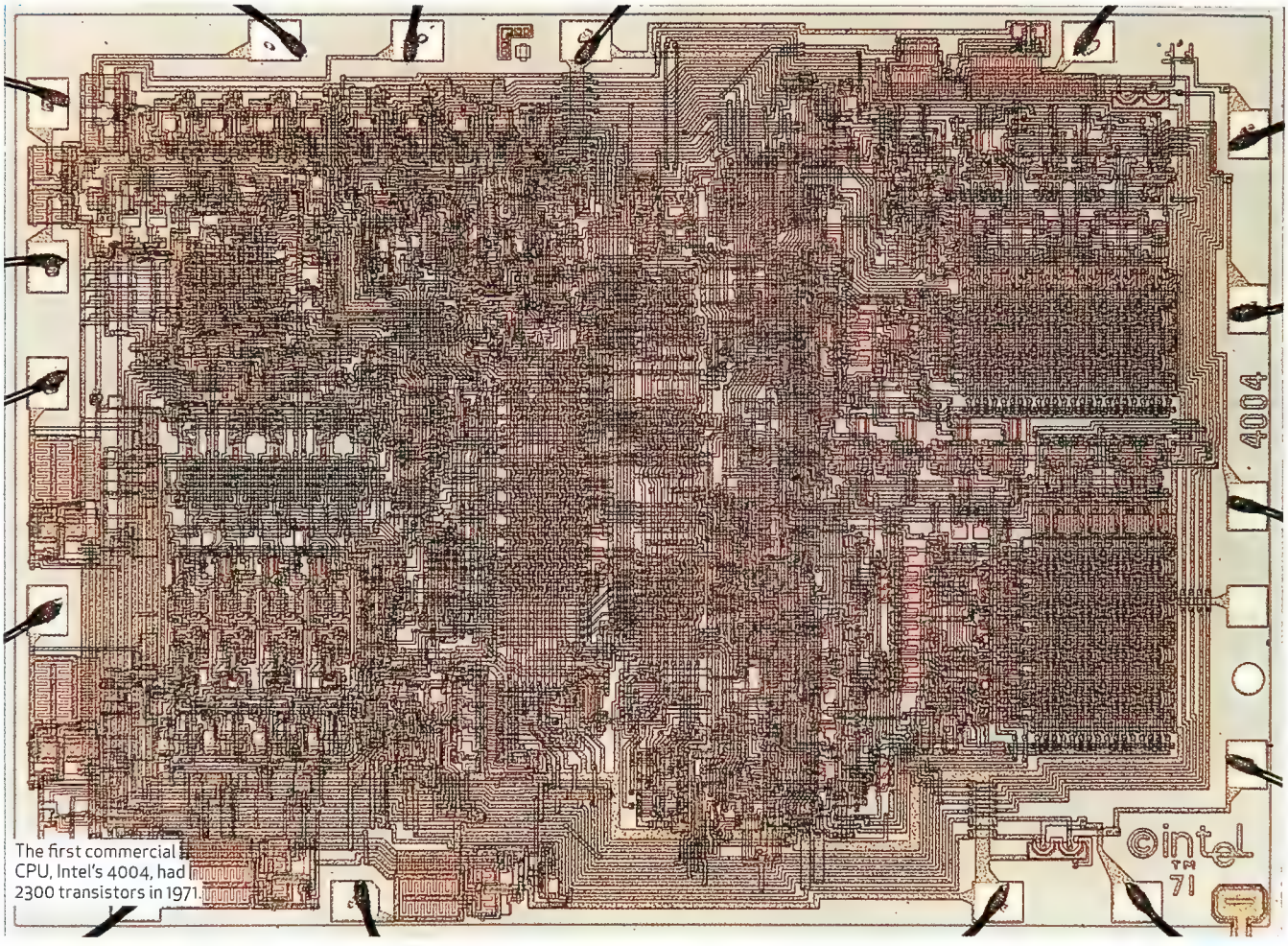
WE UNCOVER THE PAST, PRESENT & FUTURE OF THE PERSONAL COMPUTER



46 THE NEW PC
It's changed the way we work and play, but does the PC still have a future? Darren Yates looks back at the changes — and what we might see next.

50 THE PC GOES PINT-SIZED
Mini PCs are squeezing a full system into a box you can hold in one hand. Lindsay Handmer tests 10 of the latest to sort the best from the rest.

58 ALL FOR ONE, ONE FOR ALL
All-in-one PCs sandwich the desktop PC into a neater, leaner package. Craig Simms tests six of the latest to find out which are worth considering.



The first commercial CPU, Intel's 4004, had 2300 transistors in 1971.

The new PC

It's changed the way we work and play, but does the PC still have a future? Darren Yates looks back at the changes — and what we might see next.

When integrated circuit inventor Bob Noyce got together with mate Gordon Moore in 1968 to create a little start-up called 'Intel', it's unlikely even they could've imagined just where its products would eventually lead. In three years, the company had produced the world's first commercially-available microprocessor called the '4004'. But by 1980, the company was far from alone in making CPUs. The home computer market was booming on the back of processors from the likes of MOS Technology (its popular low-cost 6502 powered everything from the Commodore PET to the Apple II) and Zilog (which ran the Sinclair ZX80-series and most of Tandy's TRS-80 models with the Z80 CPU).

At the same time, IBM was big in the mainframe business, allowing the home computer revolution to instead turn Apple, Commodore and Tandy into household names. But with the home market then valued at around US$150 million (about US$500 million today) and growing fast, IBM then-boss Frank Cary wanted in. Word is, for years, Cary had wanted IBM to do a personal computer, but rather than leave it to IBM's well-known bureaucracy, he and CEO Bill Lowe put together a small, crack team, lead by project chief Don Estridge and lead engineer Bill Sydnes, and gave them the go-ahead.

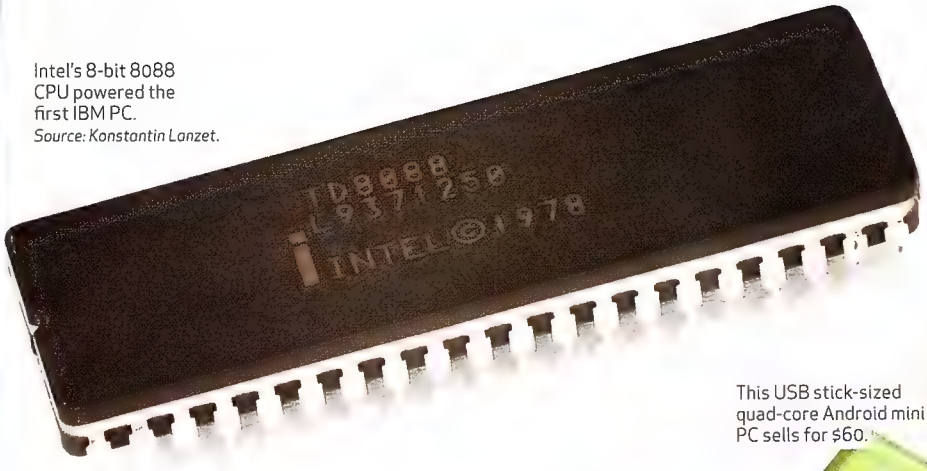
DOING THE UNTHINKABLE

During that mid-late-1970s period, computer design, generally, was a proprietary process and treated with all but the same secrecy as the formula for Coca-Cola. But being late to the party, IBM didn't have time for a new proprietary design. The market was growing and Cary didn't want to hang about – he wanted an IBM computer ready to go within the year.

So Estridge, Sydnes and the team made a decision that PC users the world over should be forever thankful for – instead of going all 'proprietary', they determined to build a computer using off-the-shelf components. Not only that, the IBM computer would have an open design – not only would third-party hardware makers have access to the technicals and be able to build expansion card hardware, but, horror of horrors, third-party software developers could code software for it. Eventually, you'd even be able to buy competitor computers that shared the same architecture!

A CHANGE IN THE WIND

It's hard to get a sense, today, of just how much of a radical departure this was to prevailing attitudes of the time, particularly regarding software development. It left more than a few old hands stunned, but coming to market late had its advantages. Estridge could see that locking up software



Intel's 8-bit 8088 CPU powered the first IBM PC.
Source: Konstantin Lanzet.

This USB stick-sized quad-core Android mini PC sells for $60.

development would only tie the company in knots and for IBM to succeed, the best plan was to open the PC up. A fascinating *PC Magazine* interview from 1982 with Sydnes and Estridge gives the story (**tinyurl.com/mb4q9hd**) and here, Sydnes gave his view of the PC – "The definition of a personal computer is third-party hardware and software."

Reports are that the first prototype was demonstrated to management on 8 August 1980 and Project Chess given the green light. Then, almost exactly a year later on 12 August 1981, IBM announced the Personal Computer 5150, powered by Microsoft DOS 1.0 and Intel's 8-bit 8088 CPU. It was an instant hit and it's been reported IBM was selling as many as 250,000 of them a month (**tinyurl.com/lcvr68t**).

Eighteen months later and IBM launched the XT, amazingly still with the same 4.77MHz Intel 8088 CPU, but now with DOS 2.0, built-in 5.25-inch 360KB double-sided floppy drive and a 10MB (0.01GB) Seagate hard drive – the bones of the modern PC as we know it were taking shape. (And damn, were those bones heavy! IBM mainframes were known for their engineering but these XT chasses were all but bullet-proof! The cases were made from steel and you dreaded the thought of having to move one between desks.)

> **"The PC revolution had made IBM and 'IBM-compatible' the new buzzwords."**

By the mid-1980s, the open-architecture decision was already paying off handsomely as expansion cards and software became readily available. While the likes of Commodore, Tandy and Sinclair would continue to make computers for some time yet, the PC revolution had made IBM and 'IBM-compatible' the new buzzwords.

INTEGRATION IS INNOVATION

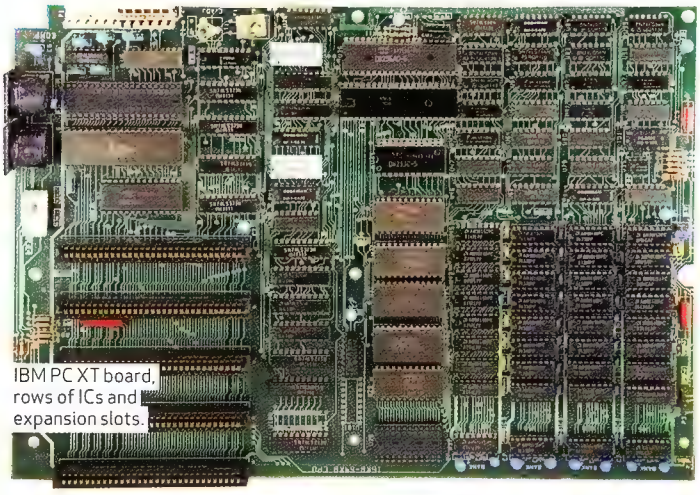
What's remarkable about IBM's design is that in the time since, it's been the 'grandpa's axe' of tech – it's had many new blades and as many new handles, however, its legacy continues on today. But how has it survived and why has it been so instrumental to computing for more than 30 years?

Some might consider PC innovation to happen at something approaching glacial pace – and looking back, you wouldn't have been too far wrong (that IBM could sell the same CPU in two different computers two years apart and not be laughed at, for example, would be unthinkable today). But it's actually more like watching a wildlife documentary on coral reefs. Things look peaceful on the surface at normal speed, but speed up the video and it's a seething mass of markets, architecture standards and manufacturers all clambering over each other for top-spot.

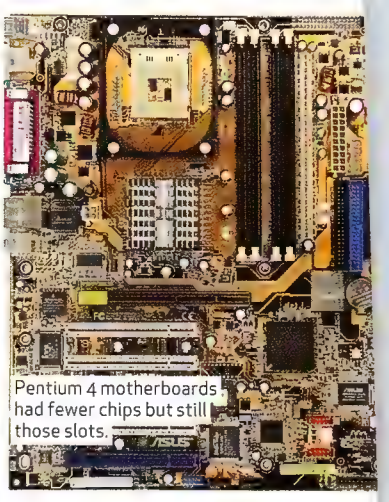
Ultimately, opening up the PC architecture to anyone who was interested was IBM's bravest and finest decision. It fed competition and created

The first PC, IBM's Personal Computer Model 5150.
Source: Rama Bolo.

Is the all-in-one form-factor the future of the PC?


IBM PC XT board, rows of ICs and expansion slots.

Gigabyte's new GA-Z97-HD3 board – will expansion slots ever die?


Pentium 4 motherboards had fewer chips but still those slots.

the famed 'IBM-compatible' catchphrase – and that fed innovation. And it was innovation that led to what has kept the PC alive and relevant for so long – integration.

Intel's 4004 CPU was one of the first major examples of Very Large Scale Integration (VLSI), the process of squeezing thousands of transistors into an integrated circuit (IC). This integration has fuelled the longevity of the PC as it's passed through three major integration transitions of its own – the initial integration of new features via the expansion slots; the integration of those expansion card functions into the motherboard; and the increasing integration of motherboard features right into the CPU.

INTEGRATION 1.0

The 4004 CPU from 1971 stopped the clock at a very modest 740kHz (0.74MHz) with 2,300 transistors, each 10-micrometres (0.01mm) in scale. By the time IBM launched the 5150, the 8088 CPU counted 29,000 transistors that could reach 8MHz clock speed and each was only a third of the scale of those in the 4004. As 1982 closed, the 16-bit 80286 CPU cranked up the transistor count to 134,000, each was half the scale again and would eventually top out at 25MHz.

The PC was hugely popular as a business machine befitting the 'IBM' name during the 1980s, but it wasn't until 1989 when Creative Labs launched the first 8-bit Sound Blaster PCM sound card that the PC found its true voice. Combined with VGA graphics card and the DB-15 joystick port, the PC's ISA expansion bus had found a new legion of fans – gamers.

INTEGRATION 2.0

By the mid-1990s, Intel and rival AMD had settled their legal squabbles and the CPU clock speed wars got under-way in earnest. CPU clock speeds began rising quickly with the arrival of the Pentium CPU and now the motherboard took on new significance – not only for supporting new CPUs (and the new sport of overclocking cheaper, slower ones), but for the new features the boards began to incorporate. While expansion slots were still useful for big-budget items like performance graphics cards, continued IC development began seeing some of these functions previously only found on expansion cards now integrated into new motherboards. The era of the mass-market DIY PC builder had arrived. In 1999, Intel launched the 'Integrated Graphics Processor' into its 810 chipset and for the first time, a PC didn't need a dedicated graphics card.

By 2003, integrated Ethernet ports, USB, multi-channel audio, Firewire and a range of storage I/O options from IDE to SATA meant motherboards took on as much importance as the CPU itself.

INTEGRATION 3.0

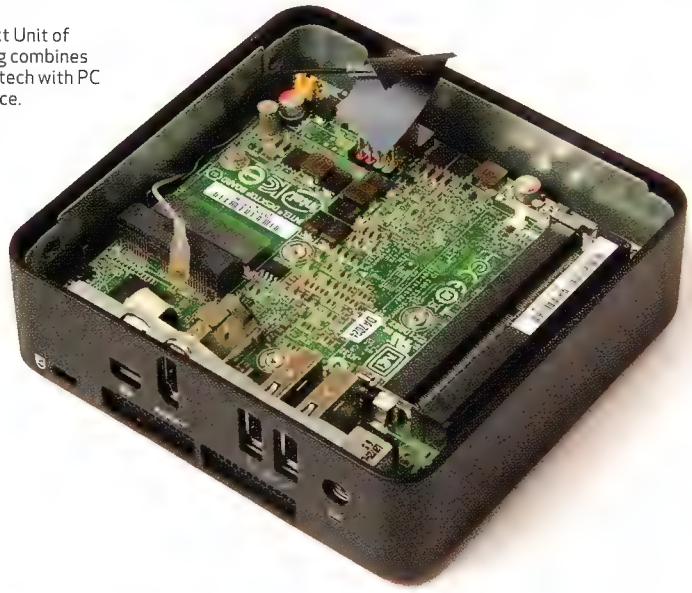
Meanwhile, endless research into chip physics continued the miniaturisation of the transistor. The ability to fill silicon wafers with an ever-increasing number of these CPU building blocks resulted in functions that used to live on expansion cards, before integration onto motherboards, were now finding homes within the CPU itself.

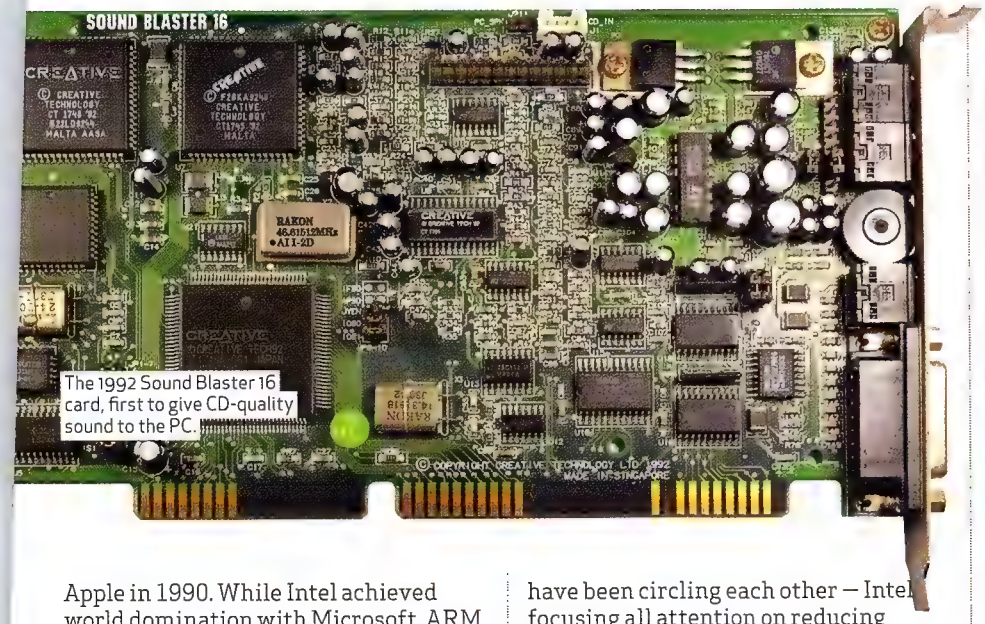
By the late-2000s, the twin-chip north/southbridge bus linking architecture had its day, with the Northbridge half disappeared into the CPU and with the arrival of Clarkdale CPUs in 2010, Intel began integration of GPU tech right into the processor. Today, even the sound card that once existed as an expansion card before becoming a chip on the motherboard, is now integrated into Intel Broadwell CPUs. Meanwhile, AMD, not able to continue matching Intel for raw speed, jumped on the Integration 3.0 bandwagon with relish, bringing in Radeon-grade GPUs inside its latest A-series processors.

In neither case has integrated performance matched the best dedicated graphics cards, but it outlined the future, not just for gamers, but the PC as a whole. Look at the die of any new-generation PC processor chip today and the proportion of silicon that's actual 'CPU' is lucky to be a third.

SYSTEM-ON-A-CHIP

But the PC has a parallel story – that of ARM Holdings, the chip designer launched as a joint-venture between Acorn Computers, VLSI Technology and


Intel's Next Unit of Computing combines notebook tech with PC convenience.



The 1992 Sound Blaster 16 card, first to give CD-quality sound to the PC.

Apple in 1990. While Intel achieved world domination with Microsoft, ARM quietly went about building its own revolution, first glimpsed with the Apple Newton in 1993. The Personal Digital Assistant of the early-2000s gave us another glimpse of the future but the PocketPC with its battery-powered, palm-sized delivery ultimately failed to click with consumers. It may have lost this round, but hand-held computers would return.

That happened in 2007 with the launch of the Apple iPhone and in an instant, the PC began looking all of its 26-years and part of tech's ancient history. ARM's decision to follow a reduced-instruction set computing (RISC) architecture now proved a masterstroke. With the launch of the HTC Dream the following year and running the first version of Google's recently-purchased Android OS, the seeds were sown for the platform war that's still with us today.

ARM had successfully created demand for its System-on-a-Chip (SoC) processor technology and all of a sudden, computing was about portability and battery life in new measure. Since then, Intel and ARM have been circling each other – Intel focusing all attention on reducing power consumption and getting its chips into phones and tablets; ARM throwing more cores and all the performance it can muster into its Cortex A-series SoCs, even angling a few into server applications.

WHERE TO NOW FOR THE PC?

But with the computing market now more fragmented than ever, where does that leave the PC? Does IBM's open architecture legacy still have a place? Almost since the first notebook, reports of the desktop PC's death have been greatly exaggerated. But so far, all of these levels of integration we've seen have been within the PC itself, as expansion cards folded into motherboards and into the CPU. But with that integration now reaching SoC-level (look inside Intel Broadwell and AMD A-series CPUs for instance), unless you're a gamer, the desktop PC is mostly just a big empty box.

But continued CPU integration with current transistor technology will only get you so far. Power consumption is one issue, but the flipside is power dissipation – for each new feature you integrate into a processor, you need power reduction from somewhere else, either by efficiency gains or transistor size reductions, to keep a lid on temperature rises. That's just basic physics. It's also why you don't see a Core i7 CPU with GeForce GTX 980-grade graphics. Technically, it's possible – you could tape out the die, but it'd melt the moment you powered it up.

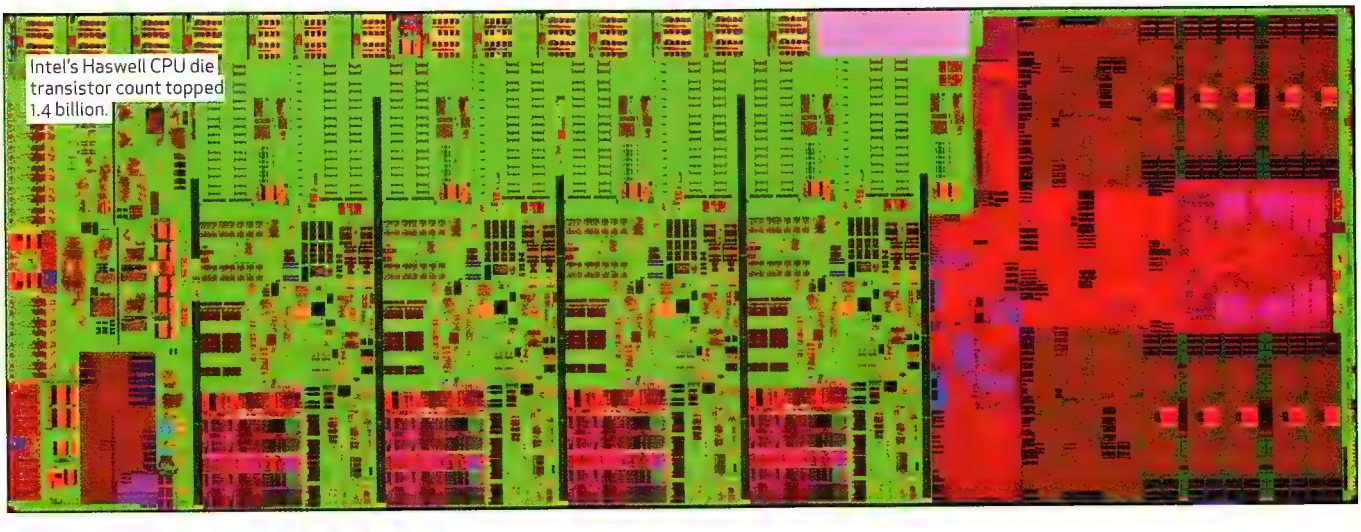
That's the reason why the Mini-ITX form factor will become an increasing part of the PC's future – it reduces form-factor, but still allows for genuine desktop-grade performance and enthusiast features such as full cooling and external GPU cards.

MANY THINGS TO MANY PEOPLE

The open architecture standard IBM created nearly 34 years ago is ultimately what keeps the PC going. Quite what we'd have now if IBM had chosen proprietary over open-standard doesn't bear thinking about.

The reality today is that what we call the 'PC' means different things to different people. To one, it's a desktop tower case; to another, it's a notebook. To one, it's a sleek all-in-one; to another again, it's a compact BitFenix Mini-ITX case and yet another, Intel's Next Unit of Computing (NUC). The look and shape of the PC will continue to evolve, no question, but hopefully what won't change is the openness of the architecture that underpins it – long may it not only survive, but continue to flourish.

Put simply, the desktop PC still works because there is no computing device for the average consumer that combines its versatility with such speed. It continues to innovate and continues to deliver the experiences we desire. And with Microsoft launching Windows 10 later this year and Intel expected to launch both Broadwell and Skylake-class CPUs – with even more integration – it's a pretty safe bet the PC as we know it will still be around for some time yet. ■


Intel's Haswell CPU die transistor count topped 1.4 billion.

The PC goes pint-sized

Mini PCs can squeeze a full system into a box you can hold in one hand. Lindsay Handmer tests 10 to sort the best from the rest.

Thanks to efficient hardware, cheap SSDs and Intel pioneering the way with the original NUC, you can now get a mini PC for about every task. Many are simple, low-powered machines suited for use as a basic web browsing, document creation computer. Others are optimised for use as a media PC and designed to blend in to your living room. You can also get mini PCs specced for gaming – with discrete GPUs and wireless controllers for a console-like experience.

No matter your use, there are a few important things to consider. Many mini PCs are shipped barebones – typically without RAM or hard drive, though some also need a CPU or other extras such as Wi-Fi. While this means you have to buy the parts and put them together yourself, it gives more flexibility to build a PC to suit your exact need. Most mini PCs use 2.5-inch SATA hard drives, though there are a few that can take 3.5-inch drives or M.2 SSDs. Keep in mind as well that barebones means no operating system – if you don't have an OS factor that into your budget.

If you want to use your mini PC for intensive tasks such as video editing or gaming, steer clear of the low voltage efficient CPUs. The higher end Intel HD graphics can give OK frame rates for casual gaming, but a discrete GPU is your best bet.

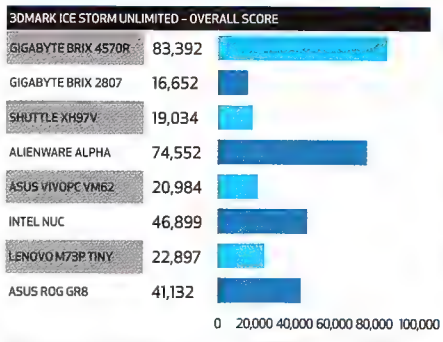
For those who want an alternative to Windows, we also tested high and low end ChromeOS mini PCs.

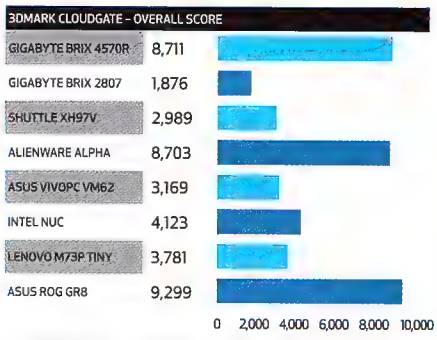
HOW WE TESTED

Barebones machines had 4 or 8GB of Kingston DDR3 installed, as well as a Samsung 850 Pro 256GB SSD. Testing was done under Windows 8.1, or the pre-installed ChromeOS. GRID 2 was tested at 1080p with details set to high.

LABS BENCHMARK RESULTS

Gaming & general system performance


3DMARK ICE STORM UNLIMITED – OVERALL SCORE
GIGABYTE BRIX 4570R 83,392
GIGABYTE BRIX 2807 16,652
SHUTTLE XH97V 19,034
ALIENWARE ALPHA 74,552
ASUS VIVOPC VM62 20,984
INTEL NUC 46,899
LENOVO M73P TINY 22,897
ASUS ROG GR8 41,132
0 20,000 40,000 60,000 80,000 100,000


3DMARK CLOUDGATE – OVERALL SCORE
GIGABYTE BRIX 4570R 8,711
GIGABYTE BRIX 2807 1,876
SHUTTLE XH97V 2,989
ALIENWARE ALPHA 8,703
ASUS VIVOPC VM62 3,169
INTEL NUC 4,123
LENOVO M73P TINY 3,781
ASUS ROG GR8 9,299
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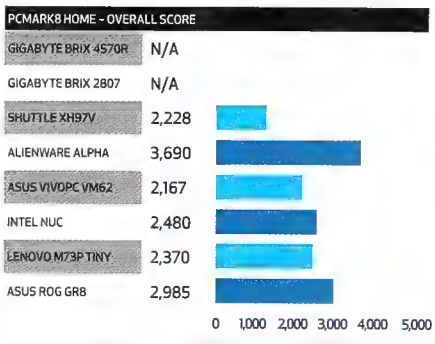
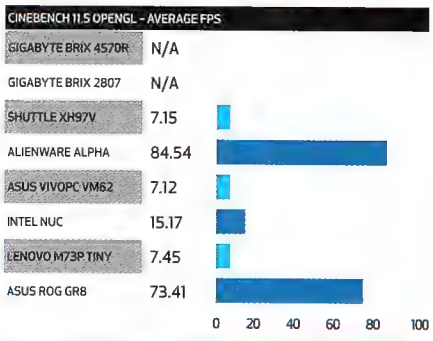
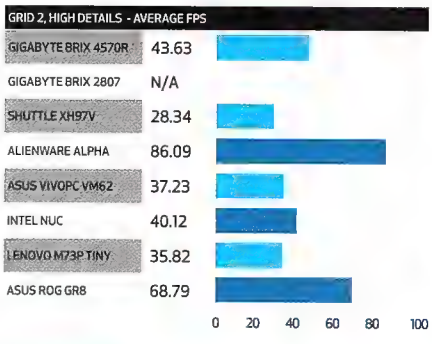
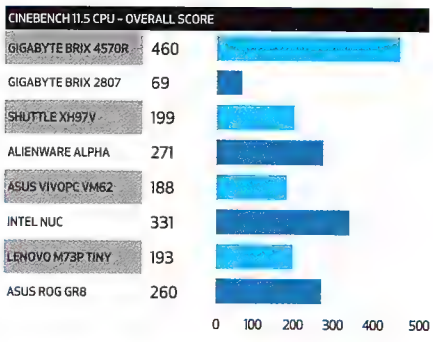
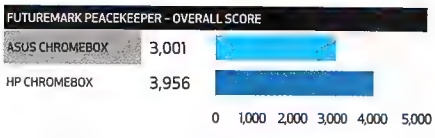

PCMARK8 HOME – OVERALL SCORE
GIGABYTE BRIX 4570R N/A
GIGABYTE BRIX 2807 N/A
SHUTTLE XH97V 2,228
ALIENWARE ALPHA 3,690
ASUS VIVOPC VM62 2,167
INTEL NUC 2,480
LENOVO M73P TINY 2,370
ASUS ROG GR8 2,985
0 1,000 2,000 3,000 4,000 5,000

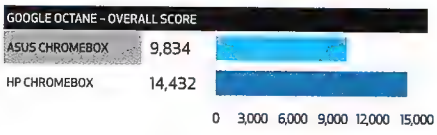

CINEBENCH 11.5 OPENGL – AVERAGE FPS
GIGABYTE BRIX 4570R N/A
GIGABYTE BRIX 2807 N/A
SHUTTLE XH97V 7.15
ALIENWARE ALPHA 84.54
ASUS VIVOPC VM62 7.12
INTEL NUC 15.17
LENOVO M73P TINY 7.45
ASUS ROG GR8 73.41
0 20 40 60 80 100


GRID 2, HIGH DETAILS – AVERAGE FPS
GIGABYTE BRIX 4570R 43.63
GIGABYTE BRIX 2807 N/A
SHUTTLE XH97V 28.34
ALIENWARE ALPHA 86.09
ASUS VIVOPC VM62 37.23
INTEL NUC 40.12
LENOVO M73P TINY 35.82
ASUS ROG GR8 68.79
0 20 40 60 80 100


CINEBENCH 11.5 CPU – OVERALL SCORE
GIGABYTE BRIX 4570R 460
GIGABYTE BRIX 2807 69
SHUTTLE XH97V 199
ALIENWARE ALPHA 271
ASUS VIVOPC VM62 188
INTEL NUC 331
LENOVO M73P TINY 193
ASUS ROG GR8 260
0 100 200 300 400 500

Chromeboxes





$699 | WWW.ALIENWARE.COM.AU
CPU: Intel Core i3 4130T, RAM: 4GB DDR3, GPU: GeForce GTX 860M, HDD: 500GB 5400RPM, 1x HMDI input and output, 2 x USB 2.0, USB 3.0.

Alienware Alpha

Is this the Steam box you have been waiting for?

When Valve delayed Steam OS and its funky controller, Dell wasn't going to sit around and let its prototype machine get out of date. Instead, it launched with Windows 8.1 and a wireless Xbox controller. Upon first boot, you launch directly in the Alpha UI, which lets you launch Steam and change settings using just the controller. This means you can use the Alpha just like a console, except play your steam games. You can also jump over into Windows proper and use a keyboard and mouse.

Our model combines a relatively low end Core i3 4130T CPU with an Nvidia GeForce 860M GPU, 4GB of RAM and a 500GB HDD – similar to what you would find in a cheaper gaming laptop. If you want more grunt, there are also more powerful Core i5 and i7 models with more RAM and larger hard drives, albeit for a large price hike. The Core i3 and 860M combo is actually pretty good – the idea being that the Alpha can run decent frame rates at 1080p on your TV. Some games you will need to drop the quality back to medium to keep the frames rates up, but games do look a lot more detailed than on a console. Overall the experience was good, though it was sometimes buggy navigating with just the controller.

The Alpha measures in at 76.2 x 203.2 x 203.2mm, has HDMI 1.4a output and input, as well as 2x USB 3.0 and 2.0, Gigabit LAN and optical audio out. You also get Intel 802.11ac Wi-Fi and Bluetooth 4.0.

Verdict

Better than expected, the Alpha is a very usable Steam machine.

★★★½☆

$1,299 | WWW.ASUS.COM.AU
CPU: Core i7-4510U, RAM: Up to 16GB DDR3, GPU: GeForce GTX 750Ti, HDD: 2.5-inch, 1 x HMDI, DisplayPort, 4 x USB 3.0, 2 x USB 2.0

ASUS ROG GR8

The ultimate lounge-room mini PC?

Designed to compete with consoles, the ROG GR8 runs Windows but will also be compatible with Steam OS when it launches. The GR8 features a more powerful processor than most – a dual core Intel Core i7 4510U that runs up to 3.1GHz but has a low 15W TDP. It also has a NVIDIA GeForce GTX 750Ti with 2GB of RAM. You don't get a HDD or any RAM, but the GR8 can handle up to 16GB of DDR3 and 2.5-inch drives. Installation is super simple too – you just pop off the side of the case.

The GR8 is reasonably powerful without going overboard and will play all your favourite games. You will mostly need to stick to a 1080p resolution and details on medium, but compared to a console the graphics detail is excellent. While the system is capable of outputting 4K, it's not going to run many games at that resolution. Even under load it's very quiet and pretty much won't be audible if gaming in the living room.

The GR8 is a little bigger than some mini PCs, measuring in at 238 x 245 x 60mm (a 2.5L chassis) and weighing 1.28kg. It has both HDMI and DisplayPort outputs, as well and both front and rear audio I/O jacks. It also has built in 802.11ac Wi-Fi, Gigabit LAN, 4x USB 3.0 ports and an extra pair of USB 2.0 connections.

For more power, ASUS also has the GR20 – a larger i7 powered mini PC with a GTX 780.

Verdict

A solid lounge room gaming PC, but the price is a little hard to swallow.

★★★☆☆

$415 | WWW.ASUS.COM.AU
CPU: Core i3-4030U, RAM: Up to 16GB , GPU: Intel HD 4600, HDD: 2x 2.5-inch, 1 x HMDI, DisplayPort, 4 x USB 3.0, 2 x USB 2.0.

ASUS VivoPC VM62-G038M

A capable home, office or media PC.

ASUS has been building mini computers for quite some time now, with a large range of stylish brushed aluminium clad VivoPC options available.

We are testing the VM62-G038M – a Core i3-4030U powered machine on the more affordable end of the spectrum. It's a barebones system – you will need to supply your own RAM (2 slots, up to 16GB 1,600MHz) and hard drive. It actually has dual 2.5-inch bays, so you can drop in an SSD for speed and a secondary hard drive up to 1TB for cheaper large-capacity storage.

The VivoPC makes accessing the drives and RAM super easy, with a clip off lid, though you need a screwdriver to remove the drive bay.

The Core i3 is more than capable of handling everyday tasks or streaming HD media. The Intel HD 4600 graphics are not too bad either and will handle casual gaming, run dual screen and can output 4K.

The VivoPC has 802.11ac Wi-Fi and Bluetooth 4.0 built in, as well as a Gigabit LAN port. Round the back you get an HDMI and DisplayPort output, card reader, 4x USB 3.0, 2x USB 2.0, 3.5mm audio jacks and an optical SPDIF audio output. It also has dual 2W speakers built in, powered by ASUS SonicMaster audio. The VM62 measures in at 190 x 190 x 56.2mm, weighs 1.2kg and uses an external laptop style PSU.

If you want a little more grunt, you can also get the VM62 with a Core i5-4210U CPU for about $100 more.

Verdict

A stylish little PC with handy dual HDD capabilities.

★★★½

$170 | WWW.GIGABYTE.COM
CPU: Celeron N2807, RAM: Up to 8GB, GPU: Intel HD, HDD: 2.5-inch SATA 2, HMDI, VGA, 2 x USB 2.0, 1 x USB 3.0.

Gigabyte Brix 2807

A mini PC that won't break the bank.

If you don't need the full on power of the Brix 4570R, there is also a low power, low cost Celeron model available. It uses Intel's 22nm Bay Trail N2807 CPU, with dual cores chugging along at 1.58GHz, though able to boost up to 2.17GHz. The 2807 is not exactly a powerhouse of a PC, but the plucky little Celeron does an excellent job with low impact tasks such as surfing the net or editing word documents.

It's also got an HDMI output and is fan-less, so makes a good basis for a media PC or server. It's got VGA, which is a handy legacy option and will actually let you run dual monitors.

The Brix 2807 is barebones – you can add up to 8GB of RAM (in one slot) and a SATA 2 2.5-inch HDD. It has built in 802.11n Wi-Fi and Gigabit LAN, as well as Bluetooth 4.0, 3.5mm audio I/O, dual USB 2 and a single USB 3.0 port on the front panel. The 2807 measures in at 107.6 x 114.4 x 56.1mm – the typical NUC mini PC size. The mini PC comes with a wall mount and VESA bracket, making it easy to mount in an out the way space. It also runs on 12v (needing 2.5A), making it a good choice to run in a car, boat or caravan. The 2807 was launched mid last year, and while it was pretty affordable at the time, prices have dropped and it's now excellent value.

Verdict

A capable low end PC for those on a tight budget.

★★★★

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THERMALTAKE TOUGHPOWER DPS G

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The new **Thermaltake Toughpower DPS G** PSU offers industry leading precision monitoring and control of your system. Allowing you to lock down and engage, track, record and quantify not only your power supplies efficiency and usage - but other core system components as well like your CPU and GPU.

Through Thermaltake's groundbreaking DPSapp software, you can easily monitor the electricity cost of your PC - allowing you to manage your expenses. On top of this, you can also see your systems component wattage, voltage, efficiency and temperatures.

The **Thermaltake Toughpower DPS G** is built with a fully modular cabling design meaning a tangled mess at the bottom of your case is a thing of the past. Now you only have to use only the cables you need - resulting in optimal system airflow and massively reducing cable clutter.

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The Toughpower DPS G with DPSApp Software delivers up to 87%-92% efficiency under real-world load conditions, promising the lowest power losses. In addition to this, the DPS G Series has been optimised to work with Intel's latest fourth-generation Haswell processors to achieve maximum energy savings.

100% 105°C Japanese Electrolytic Capacitors and 7 Year Warranty

Thermaltake uses 105oC/221oF Japanese brand capacitors, which greatly improves component durability and offers the highest levels of stability and reliability. Thermaltake also packs an incredible 7 Year Warranty on all DPS G PSU's.

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Toughpower DPS G series is equipped with a powerful single +12V rail. Allowing you to build a rig that's more powerful than ever through multi-GPU configurations.

Whether you're building something that's small, medium or big on power - the Thermaltake Toughpower DPS G has enough power to get you through. Available now in Australia with 650W, 750W, 850W and 1050W models.

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Thermaltake Toughpower DPS G.

$599 | WWW.GIGABYTE.COM
CPU: Core i5-4570R , RAM: Up to 16GB, GPU: Intel Iris Pro 5200, HDD: 2.5-inch SATA 3, mSATA, 1 x HMDI, mini DisplayPort, 4 x USB 3.0.

Gigabyte Brix GB-BXi5-4570R

Available in standout red or blend in black.

A high performance option, the Brix 4570R features an Intel Core i5-4570R CPU that runs at 3.2GHz, with a 3.6GHz boost speed. This processor is no slouch – it's got four cores, a hefty 84W TDP and Intel Iris Pro 5200 graphics. Not surprisingly it performed very well in our benchmarks and is capable of decent mid-range gaming or more intensive tasks such as video editing. Under load the Brix does get pretty noisy but most of the time it's fairly quiet. Very slightly chunkier than the smaller mini PCs, the Brix measures in at a still tiny 62mm high, and 114mm across each side.

The Brix is a barebones PC – while it includes the CPU you need to add your own RAM (two slots, up to 16GB 1,600MHz) as well as a 2.5-inch SATA 3 HDD or mSATA drive. It does have an 802.11ac mini PCIe Wi-Fi card installed, which also features Bluetooth 4.0. On the front the Brix has dual USB 3.0 ports, as well as a headphone jack with optical SPDIF. In the rear the mini PC has HDMI, mini DisplayPort, two more USB 3.0 ports and Gigabit LAN. You can run dual monitors and as well as output 4K – though don't expect to do much gaming at this resolution. The 4570R uses a chunky external PSU – a 19v 7.1 amp monster that takes up significant space. The Brix comes with a VESA bracket, making it easy to mount out of the way on the back of a monitor.

Verdict

Fully featured and high power, for a price.

★★★★☆

$469 | WWW.INTEL.COM
CPU: Core i5-4250U, RAM: Up to 16GB DDR3, GPU: Intel HD 5000, HDD: 2.5-inch SSD or mSATA, 1 x mini HMDI, DisplayPort, 4 x USB 3.0.

Intel NUC kit D54250WYK

A versatile barebones mini PC.

It's no surprise that Intel does the mini PC well – the D54250WYKH measures 116 x 112 x 34.5mm and weighs just 0.5kg. The NUC uses a soldered in Core i5-4250U – a dual core CPU that can run up to 2.6 GHz and has a 15W TDP. You do need to add in your own RAM and HDD – up to 16GB of DDR3 and a SATA 3 2.5-inch or mSATA SSD. If you want Wi-Fi, the NUC has the cables and antenna but you need to add your own wireless card via the mini PCIe slot.

While not super powerful, it does have the quite decent Intel HD 5000 graphics that will handle casual gaming. It can also handle 4K video via HDMI or DisplayPort and has an IR receiver – making it well set up for use as a media PC. Frustratingly though, both are mini ports and while saving space is great, there was easily enough room for full size connectors. Under load the NUC fan does get audible, but it's not loud enough to be an issue.

Round the back you get dual USB 3.0 ports, Gigabit LAN and the video outputs. The front features two more USB 3.0 connections and a 3.5mm I/O jack driven by the Intel HD audio.

The NUC is actually rated at 12 -19v, so while it has a 19v power adaptor; you could run it from a 12v source such as car or caravan. You can also VESA mount the Intel NUC.

Verdict

Costly after a full spec out but strong performance.

★★★½☆

$650 | WWW.LENOVO.COM
CPU: Intel Core i3-4130T, RAM: 4GB DDR3, GPU: Intel HD Graphics 4400, HDD: 500GB 7200 RPM, 1 x DisplayPort, VGA, 4 x USB 2.0, 2 x USB 3.0.

Lenovo M73p Tiny

Aimed at business users.

The M73p Tiny is quite plain and very square, with a small 1L chassis. Lenovo opted for a flatter design than most mini PCs, which can be handy if you want to VESA mount it.

Buried inside the slim form is an Intel Core i3-4130T – an older dual core CPU that runs at 2.9GHz. It has Intel HD 4600 graphics, a 500GB hard drive and 4GB of RAM. Performance is about what you would expect – on the lower end but more than capable of handling typical office tasks. It does have a 35W TDP though, so is not as efficient as more modern setups.

One handy feature of the M73 is the optional DVDRW – still a must have for many business users. Essentially the same form factor as the PC, just thinner, the optical drive piggy backs on the side. You also get a standard Lenovo wired keyboard and mouse and can power on by hitting Alt-P.

Round the back the M73 has a DisplayPort, VGA, 4x USB 2.0 ports and Gigabit LAN. You don't get HDMI, though it does have built in 802.11n Wi-Fi and Bluetooth. On the front panel you get dual 3.5mm audio I/O connections and two USB 3.0 ports – one of which supports charging even when the M73 is off. The unit measures in at 177 x 177 x 35mm and weighs 1.3kg.

If you need a little more processing grunt, the M93p Tiny has a Core i5-4570T CPU and Intel 4600 graphics, though costs at least $350 more.

Verdict

A solid but slightly older tech office workhorse.

★★★½☆

apc RECOMMENDS

$350 | WWW.SHUTTLE.COM
CPU: Intel Core i3-4130, RAM: Up to 16GB, GPU: Intel HD 4400, HDD: 2 x 2.5-inch or 1 x 3.5-inch, 2 x DisplayPort, 1 x HMDI, 4 x USB 2.0, 4 x USB 3.0.

Shuttle XH97V

For those who need multiple monitors.

Unlike the other Mini PCs, the Shuttle XH97V takes barebones to the extreme and you have to supply your own CPU. While this adds to the cost, it also means you can spec it out exactly as you want it. The Shuttle supports Intel Haswell CPUs up to 65w TDP on the H97 chipset. We tested with an i3-4130 CPU, which will set you back about $150. You also need to add up to 16GB of RAM and a 2.5-inch HDD. Installation is easy enough, with a heat pipe cooling setup that clips into place like a typical CPU cooler.

One stand out feature of the XH97V is the ability to support triple displays, all running 1080P, or up to 4K on a single monitor. This is handy for those who like to multi task on multiple screens and also makes the Shuttle a capable digital signage PC.

The XH97V supports a range of drive options with three STA connectors – you can fit a single 3.5-inch drive, dual 2.5-inch drives, a single 2.5-inch drive and a slim ODD as well as an mSATA SSD. On the front you get 2x USB 2.0 and 3.0 ports, as well as dual 3.5mm audio I/O. Round the back the Shuttle has another 2 of both USB 3.0 and 2.0 ports, audio I/O, HDMI, 2x DisplayPort, 802.11n Wi-Fi, Gigabit LAN and a legacy RS232 connector.

The Shuttle is a little bigger than most with a 3.5L chassis that measures 240 x 200 x 72mm.

Verdict

A versatile mini PC that offers options not available anywhere else.

★★★★½

$249 | WWW.ASUS.COM
CPU: Intel Celeron 2955U, RAM: 2GB DDR3, GPU: Intel HD Graphics, HDD: 16GB SSD, 1 x HMDI, DisplayPort, 4 x USB 3.0.

ASUS Chromebox M093U

An alternative mini PC.

In a Windows dominated market, Chromeboxes can offer a lot of advantages for a very affordable price. The underlying hardware is very similar to Chromebooks – the M093U features a 1.4GHz dual core Intel Celeron 2955U CPU with a TDP of 15W. It's also got very basic Intel HD Graphics, 2GB of RAM and a 16GB SSD. Where the Chromebox stands out is the inclusion of a Gigabit LAN connection, 4 USB 3.0 ports and both HDMI and DisPlayPort. You also get the usual card reader, 3.5mm audio jack, 802.11n Wi-Fi and Bluetooth 4.0. The Chromebox lacks disk space, but does come with a free 100GB of Google Drive storage for two years, plus the ability to expand storage via SD card.

ChromeOS itself is excellent – it boots fast, has heaps of free apps and can handle all your typical web browsing, document creation and video playback. The PC is also very quiet and can be VESA mounted behind your monitor. You won't be playing your normal games, but there are actually plenty of fun titles available for ChromeOS.

The key advantage of the Chromebox is price – it's ready to go PC right out of the box for less than most barebones mini PCs, let alone kitted out models. The biggest competition to the Chromebox is actually a Chromebook – for as little as $50 more you can get a laptop almost the exact same spec, albeit in a slightly larger footprint. You can also grab a Core i3 model for double the price.

Verdict

An affordable little PC that can handle day to day tasks.

★★★★☆

$900 | WWW.HP.COM
CPU: Intel Core i7-4600U, RAM: 8GB DDR3 RAM, GPU: Intel HD 4400, HDD: 16GB SSD, 1 x HMDI, DsiplayPort, 4 x USB 3.0.

HP Chromebox J4R41AA

Does anyone need a high end Chromebox?

Standing out from the low end Celeron powered Chromeboxes, HP sells a model packing a Core i7 CPU and Intel HD 4400 graphics. The i7-4600U is still only a dual core processer with a 15W TDP but can burst up to 3.3GHz. The HP also has 8GB of RAM but only a 16GB M.2 SSD.

We admire HP for thinking outside the box, but it's somewhat of an odd choice. ChromeOS is well optimised for low end hardware and while it can slow down with certain apps or web pages, generally it's a smooth experience. An i7 is overkill, but then again we had zero issues with lag and everything loaded instantly.

The HP has a 10/100 Ethernet connection, as well as dual band 802.1n Wi-Fi and Bluetooth 4.0. You also get HDMI and DisplayPort outputs, a 3.5mm audio jack and four USB 3.0 ports. You do get the usual 100GB of free Google drive storage for 2 years, but no SD card slot to add extra local disk space. The HP also comes with a wireless keyboard and mouse and can be VESA mounted.

The idea of a powerful Chromebox is appealing, but ultimately the execution is flawed. The wired and wireless network options lag behind the high end on other products and it deserves a larger SSD. But the real problem is the price – Chromeboxes are meant to be affordable, but the i7 powered HP costs as much as a better specced mini PC and over three times as much as a basic Celeron Chromebox.

Verdict

A cool concept that is totally overpriced.

★★★☆☆

DrayTek
Aust & NZ
www.draytek.com.au

Professional NBN Routers

VPN, Firewall, CSM, QoS, IPv6, 3G/4G Connection, Wi-Fi, VoIP, Smart Monitor, Remote Management

Ideal solution for home and small-to-medium business networking

VDSL2 / ADSL2+ VPN Firewall Routers

TAIWAN EXCELLENCE 2012

2x VPN

Vigor2760 Series

- Built-in VDSL2 / ADSL2+ modem with USB 3G / 4G Backup
- Selectable Gigabit WAN / LAN (for NBN / Cable Connection)
- 4 x Gigabit LAN ports with 30,000 NAT sessions
- 2 x VPN tunnels with hardware accelerator
- Advanced Wi-Fi for Vigor2760n and Vigor2760Vn
- SIP VoIP (2 x FXS and 1 x Line port) for Vigor2760Vn

TAIWAN EXCELLENCE 2013

32x VPN

Vigor2860 Series

- Built-in VDSL2 / ADSL2+ modem, 1 x Gigabit WAN port & 2 x USB ports for 3G / 4G Mobile with Load Balance and Fail-Over
- 6 x Gigabit LAN ports with 50,000 NAT sessions
- 32 x VPN tunnels with VPN load balance and redundancy, Central VPN Management & 16 x SSL VPNs
- Advanced Wi-Fi for Vigor2860n
- Dual-Band Wi-Fi for Vigor2860n-Plus & Vigor2860Vn-Plus
- SIP VoIP (2 x FXS and 1 x Line port) for Vigor2860Vn-Plus

Broadband VPN Firewall Routers

2x VPN

Vigor2120 Series

- 1 x Gigabit WAN port with USB 3G / 4G Backup
- 4 x Gigabit LAN ports with 30,000 NAT sessions
- 2 x VPN tunnels with hardware accelerator
- Dual-Band Wi-Fi for Vigor2120n-Plus

TAIWAN EXCELLENCE 2014

16x VPN

Vigor2912 Series

- 2 x Fast Ethernet WAN ports & 1 x USB ports for 3G / 4G Mobile with Load Balance and Fail-Over
- 4 x Fast Ethernet LAN ports with 30,000 NAT sessions
- 16 x VPN tunnels with hardware accelerator & VPN Fail-Over
- Advanced Wi-Fi for Vigor2912n

TAIWAN EXCELLENCE 2013

50x VPN

Vigor2925 Series

- 2 x Gigabit WAN ports & 2 x USB ports for 3G / 4G Mobile with Load Balance and Fail-Over
- 5 x Gigabit Ethernet LAN ports with 50,000 NAT sessions
- 50 x VPN tunnels with Central VPN Management & 25 x SSL VPNs
- Advanced Wi-Fi / Dual-Band Wi-Fi / VoIP

i-LAN TECHNOLOGY

i-LAN Technology Pty Ltd trading as DrayTek Aust & NZ

www.i-lan.com.au (02) 9838 8899 sales@i-lan.com.au

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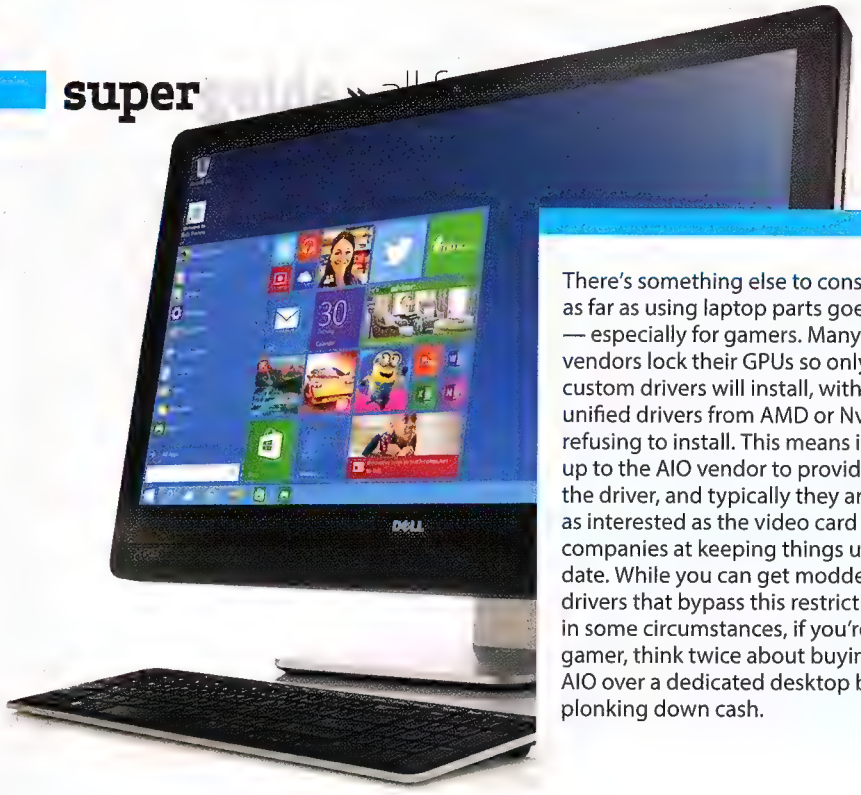


There's something else to consider as far as using laptop parts goes — especially for gamers. Many vendors lock their GPUs so only custom drivers will install, with unified drivers from AMD or Nvidia refusing to install. This means it's up to the AIO vendor to provide the driver, and typically they aren't as interested as the video card companies at keeping things up to date. While you can get modded drivers that bypass this restriction in some circumstances, if you're a gamer, think twice about buying an AIO over a dedicated desktop before plonking down cash.

All for one, one for all?

All-in-one PCs sandwich the desktop PC into a neater, leaner package. Craig Simms tests six of the latest to find out which are worth considering.

While we've always been advocates of building your own PC, there are situations where you just want to be able to pull something out of the box, switch it on, and start using it.

The all-in-one (AIO) market certainly caters to that consumer, with multiple options for multiple use cases. Usually coming with 21.5-, 23- or 27-inch screens, these machines bundle everything you need, down to a keyboard and mouse. Whether gamer, designer, home or business user, there's something out there to fit the bill.

While screen adjustability is usually limited to tilt, the units are generally light enough to swivel where they stand. While some do come with hardware buttons on the screen, don't expect the level of adjustability offered by a dedicated monitor – at most these are usually restricted to brightness adjustment and input switching.

BUYING GUIDE

The best place to start is the screen: how large do you want it? What resolution is the screen actually running at? While 1080p is fine for 21.5- and 23-inch, on a 27-inch screen things are going to look pixelated and so you'll want something higher.

You'll also have to decide whether or not you want touch. In our experience, touch is of limited use on desktops in finite situations. It's not the most natural of interfaces on a vertical surface, with most better off sticking with keyboard and mouse.

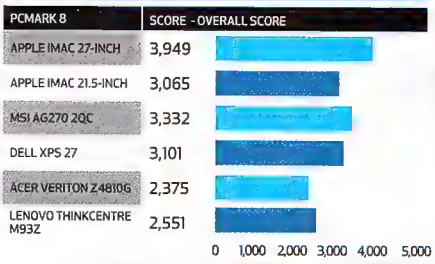
Because AIOs contain laptop-level parts, most of them should be considered non-upgradeable. Things like the 27-inch iMac's user-accessible RAM banks are the exception rather than the rule. You'll need to take into account future proofing when thinking about things like RAM and storage. This also means you shouldn't expect the massively powerful performance you'll find in fully-fledged desktops – but as you'll soon see, the performance still isn't anything to sneeze at.

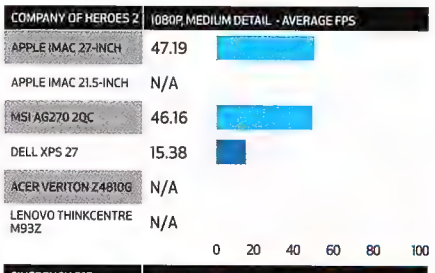
HOW WE TESTED

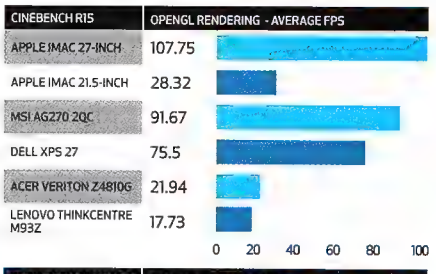
We ran PCMark 8, Cinebench R15, x264 HD Benchmark 5.01 and AS SSD on each AIO to compare performance. For those that had more powerful GPUs than Intel HD Graphics, we ran the *Company of Heroes 2* benchmark with all details set to medium at 1080p.

For the iMacs, we first installed Windows 8.1 – while we recognise they will spend the majority of their time in OS X, this allows us to establish a comparative baseline.

LABS BENCHMARK RESULTS


PCMARK 8
SCORE - OVERALL SCORE
APPLE IMAC 27-INCH 3,949
APPLE IMAC 21.5-INCH 3,065
MSI AG270 2QC 3,332
DELL XPS 27 3,101
ACER VERITON Z4810G 2,375
LENOVO THINKCENTRE M93Z 2,551
0 1,000 2,000 3,000 4,000 5,000


COMPANY OF HEROES 2
1080P, MEDIUM DETAIL - AVERAGE FPS
APPLE IMAC 27-INCH 47.19
APPLE IMAC 21.5-INCH N/A
MSI AG270 2QC 46.16
DELL XPS 27 15.38
ACER VERITON Z4810G N/A
LENOVO THINKCENTRE M93Z N/A
0 20 40 60 80 100


CINEBENCH R15
OPENGL RENDERING - AVERAGE FPS
APPLE IMAC 27-INCH 107.75
APPLE IMAC 21.5-INCH 28.32
MSI AG270 2QC 91.67
DELL XPS 27 75.5
ACER VERITON Z4810G 21.94
LENOVO THINKCENTRE M93Z 17.73
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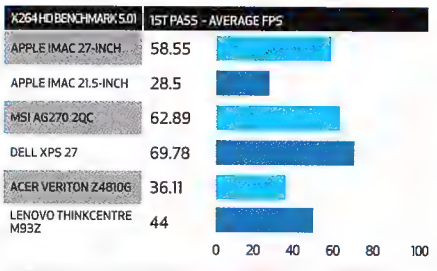
X264 HD BENCHMARK 5.01
1ST PASS - AVERAGE FPS
APPLE IMAC 27-INCH 58.55
APPLE IMAC 21.5-INCH 28.5
MSI AG270 2QC 62.89
DELL XPS 27 69.78
ACER VERITON Z4810G 36.11
LENOVO THINKCENTRE M93Z 44
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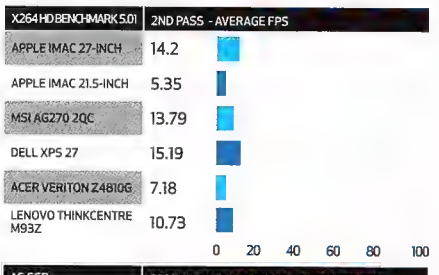
X264 HD BENCHMARK 5.01
2ND PASS - AVERAGE FPS
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APPLE IMAC 21.5-INCH 5.35
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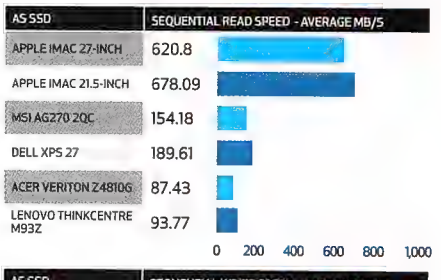
AS SSD
SEQUENTIAL READ SPEED - AVERAGE MB/S
APPLE IMAC 27-INCH 620.8
APPLE IMAC 21.5-INCH 678.09
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DELL XPS 27 189.61
ACER VERITON Z4810G 87.43
LENOVO THINKCENTRE M93Z 93.77
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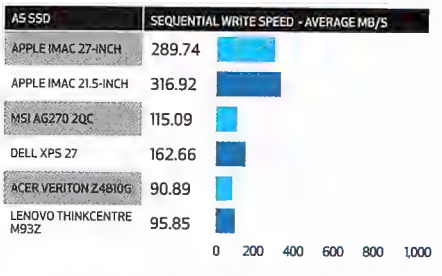

AS SSD
SEQUENTIAL WRITE SPEED - AVERAGE MB/S
APPLE IMAC 27-INCH 289.74
APPLE IMAC 21.5-INCH 316.92
MSI AG270 2QC 115.09
DELL XPS 27 162.66
ACER VERITON Z4810G 90.89
LENOVO THINKCENTRE M93Z 95.85
0 200 400 600 800 1,000

$1,759 | WWW.ACER.COM.AU

Acer Veriton Z4810G

Taking care of business.

Acer's Veriton is clearly business focused: from its stern matte black styling, to the fact that it comes with Windows 7 installed. If your business is ready for Windows 8.1, that option is available through system restore by pressing ALT + F10 during boot.

It also needed to be assembled, hinting that the screen component is expected to be attached to an existing vesa bracket somewhere.

The 23-inch IPS touchscreen provides good colours and viewing angles. Like most AIOs, the screen only has built in tilt adjustment, although the unit is light enough that the whole thing can be rotated by hand.

Compared to other AIOs in this roundup, the Veriton is modestly specced – as such, performance isn't as high, but this is reflected in its price.

Its webcam is interesting: a button needs to be hit to pop it out from the monitor, ensuring privacy. The lens can also be rotated to face either the front or the rear, although sadly this results in an inverted image. Rather than an automated switch, the user will have to do it themselves by pressing 'Ctrl-F3'.

Features are acceptable for a business scenario, with a DVD+-RW drive, one USB 3.0 port, SD card reader and microphone/headphone jacks on the left, while the rear hosts another four USB 2.0 ports, Gigabit Ethernet, HDMI in, VGA and DisplayPort out.

Acer's Veriton is a modest entry, but it doesn't pretend it's anything else. If you have straight up, non-demanding business needs, it's a decent choice.

Verdict

A straightforward, no-frills unit that does the job.

★★★½☆

$2,999 | WWW.APPLE.COM/AU

Apple iMac with 5K Retina Display

The pinnacle of screens.

Apple's iMac has long established itself as the vanguard of all-in-one computing – extremely thin design, wireless peripherals, and typically better sound and screen quality than competitors. The iMac with 5K Retina Display takes this to the extreme.

At a huge resolution of 5,120 x 2,800, the 27-inch IPS screen simply blows away competitors. For those who haven't used a high DPI display before, the effect is initially subtle. Then you begin to notice the sharper text, and high res icons. After a half hour, it becomes difficult to go back to lower resolution screens, with even 1080p seeming pixelated.

The included Magic Mouse with gesture surface is passable, but has never been great to use. For those who focus on productivity, you'll need something with better shape, precision and functionality. The keyboard is good, although we wish it were backlit.

The usual iMac traits are here: a hole in the back of the neck for cable management, and the only real adjustment is tilt. Thankfully the machine is light enough to simply rotate the whole unit, base and all.

This particular model has the bonus of coming with user accessible RAM slots, and gives you four USB ports, a gigabit Ethernet jack, SD card reader, headphone jack and two Thunderbolt ports on the rear. Unlike previous iMacs, the 5K Retina version does not allow target display mode, meaning you can't hook up a MacBook over Thunderbolt and use the iMac as a monitor.

If you've got the cash, there's no doubt that the iMac with 5K Retina Display is the king of the hill.

Verdict

Some serious cash splashing required, but a very impressive machine.

★★★★½

$1,649 | WWW.APPLE.COM/AU

Apple iMac 21.5-inch

Baby Mac.

Apple offers three base models of the iMac 21.5-inch, with our review sample featuring a Core i5 1.4GHz dual core processor, 8GB RAM and an upgraded 1TB Fusion Drive.

Configuration options abound, and if you really want power you can upgrade as high as a Core i7 3.1GHz quad core processor with 16GB RAM and a 512GB SSD.

The screen is bright and has excellent viewing angles and colour saturation, although you definitely notice the step down from the Retina display. Aesthetically and functionally it's a smaller version of Apple's flagship iMac, even possessing the same ports on the rear, with four USB ports, two Thunderbolt, SD card reader, headphone jack and a Gigabit Ethernet jack. RAM slots are not user accessible on the 21.5-inch iMac – so make sure to future proof your RAM selection.

Interestingly, the 21.5-inch iMac had better audio than the larger 27-inch, providing a deeper soundstage and more balanced sound. In contrast, the 27-inch was far too sharp on the treble end of the scale.

The iMac 21.5-inch comes with the same wireless keyboard and Magic Mouse as its larger brother, so our same criticisms apply to the mouse – if you want to do serious work, you're better off to invest in something more flexible and precise.

Thanks to excellent build quality, along with plenty of upgrade options and three base tiers to work with, Apple's iMac 21.5-inch should suit a wide variety of people looking for a desktop AIO.

Verdict

It hits a balance of cost/performance that should suit most people, with plenty of options.

★★★★½

$2,999 | WWW.DELL.COM.AU

Dell XPS 27 All-in-One

27-inches of lovin'.

Dell's XPS 27 has been with us for some time – in fact the review model we were supplied is one step older than what's on sale currently, with the CPU replaced with a Haswell Refresh chip, bumping up speeds another 100MHz. Not a huge difference, but should you buy one today, performance will come in a little higher.

The 27-inch screen looks good at 2,560 x 1,600, although colours are oversaturated, particularly the reds and greens. Audio is decent, but while there's plenty of volume to be had, the sound always seemed oddly restrained, and not as present or forward as it could be.

Features are strong, with six USB 3.0 ports in total, headphone and microphone jacks, an SD card reader, HDMI in and out, a Blu-ray drive and Thunderbolt. The included keyboard and mouse are passable, although the scroll wheel on the mouse isn't the best.

The screen can be tilted to 60 degrees off the table, making the touchscreen more natural to use than the usual almost-vertical fare. As a result, there's also minimal height adjustment from flush to about 4.5cm from the desk while the screen is vertical.

We found an issue while benchmarking with *Company of Heroes*: the game would run in a 1:1 aspect ratio rather than scale to fullscreen, resulting in black borders. It turns out this is an Nvidia Optimus problem – scaling is taken from the Intel graphics, but you can only set it to scale to full screen when not running Windows in native resolution. Looks like gaming on laptops and AIOs still isn't a perfect match.

Verdict

The best of the Windows all-in-ones.

★★★★½

$1,299 | WWW.LENOVO.COM/AU

Lenovo ThinkCentre M93z

Business class.

Lenovo's M93z comes in two flavours, with or without touch. The non-touch version, on review here, has an impressive height adjustable neck, with swivel and tilt built in – more than the usual AIO fanfare. Instead of the usual hole in the neck for cable management, there's a dedicated plastic loop built in. The touch version loses the adjustability in favour of a kickstand and adds another $250 to the price. While our review unit contained a Core i5 4430S, at retail the M93z options start at the 4460S, offering another 200MHz of performance.

Just like Acer's Veriton, this is a business focused machine, and as such ships with Windows 7, although Windows 8.1 is available.

While the included keyboard and mouse are nothing special, they are solid, with the keyboard featuring full travel keys rather than a short travel, laptop-style affair. Like many AIOs, the built-in webcam features a physical toggle that blocks the lens for privacy.

The matte, 23-inch, 1080p IPS screen is bright and pleasant to use. The ThinkCentre sports VGA in, DisplayPort out, six USB 3.0 ports, headphone/microphone jacks, gigabit Ethernet and a DVD+-RW drive. As is to be expected of a business machine, audio is best described as functional – don't expect deep bass or crisp treble here.

It can be hard to get excited about business-focused PCs, however for the price Lenovo's M93z could tickle the fancy of those with basic needs, whether at home or in business.

Verdict

A solid business focused AIO, with welcome adjustability bonuses.

★★★½☆

$3,999 | AU.MSI.COM

MSI AG270 2QC

Specced up.

MSI's AG270 2QC is an all-in-one built for gamers. This means touches like killer networking, a beefy GeForce GTX 970M and a quad core Core i7 4710HQ.

It also features a touchscreen with anti-glare coating, although the screen is deeply set, creating a slight blurred look when things are viewed off-axis. MSI has opted for a TN-based, 1080p screen, which means lower viewing angles and less accurate colours than IPS, and pixels appear quite large. On the upside, the lower resolution should help the mobile graphics drive games more easily, and TN-based screens provide the best response time. Certainly performance in our *Company of Heroes 2* benchmark was admirable.

The mouse is passable, with a chunky, pleasing scroll wheel, DPI adjustment buttons, and two thumb buttons. The keyboard, while backlit, doesn't provide the best typing response or tactile feedback, with gamers likely to opt for a higher quality replacement.

Ports are legion, with four USB 3.0, two USB 2.0, HDMI in and out ports, SD card reader, gigabit Ethernet jack, microphone and headphone jacks, and VGA out.

Our review sample featured a 1TB hard drive, however the unit hitting Australian shores should have dual 128GB mSATA SSDs in RAID 0 paired with a 2TB hard drive, providing even more performance.

The AG270 definitely has the most powerful GPU of our roundup. Still, $3,999 will be a tough ask for some gamers, who may prefer to stick to dedicated desktops for upgrade flexibility and extra performance for a more appealing price.

Verdict

While we'd prefer an IPS screen, the AG270 2QC may find a home with some gamers.

★★★½☆

Capacious, fast and compact

Need a rocket in your pocket? We compare six USB 3.0 flash drives to find out which can really meet your need for speed. Dan Gardiner

Like most forms of digital storage, USB flash drives have gotten progressively bigger and more affordable over time. And when you're dealing with size over 32GB, chances are you actually want the extra speed that USB 3.0 can theoretically provide – otherwise you end up sitting around for hours waiting for copies to finish.

While all the drives we tested for this story proudly displayed a USB 3.0 specification, the flash chips and drive controllers inside each varied significantly – and what that means in terms of real-world performance is actually quite stark.

In car terms, "supports USB 3.0" is basically the same as saying "runs on unleaded petrol" – which tells you nothing about how fast a car can go. To test the drives then, we plugged each one into the rear USB ports of an SSD-equipped Z97 desktop PC and used CrystalDiskMark (**crystalmark.info**) to benchmark the read and write speeds of each, with wildly varying results. Read on to find out which drives deliver on the USB 3.0 promise.

$249 | WWW.ANYWARE.COM.AU

$780 | WWW.KINGSTON.COM

BlueEye ThunderDisk Pro 256GB

THE PERFECT BALANCE BETWEEN CAPACITY, PRICE AND SPEED.

We're bending the rules a bit to include the ThunderDisk Pro because, frankly, it's a beauty. This is a fully-fledged mini laptop SSD that's been put in a USB housing. The caveat is that there's no USB connector, so you'll need to carry a small USB cable with the drive. If you're after the ultimate in high-speed transfers, that could totally be worth it. We measured sustained reads and writes of 396MB/s and 333MB/s, respectively: the fastest here by a wide margin. $250 might seem pricey, but on a cost-per-gig basis, it's actually one of the best-value drives here. This is a fantastically fast unit that can basically keep pace with the SSD in your laptop or desktop. Great for transferring lot of data fast.

Verdict

It's not the most convenient of portable flash drives, but its fairly priced and super fast.

★★★★★

Kingston HyperX Predator 512GB

THE BIGGEST ON TEST IN MORE WAYS THAN ONE.

The HyperX Predator is a big drive – both in capacity and physical dimensions. A hunk of solid metal roughly four times the size of most others, Kingston has sensibly provided a short USB cable here, without which the Predator would crowd out USB ports on desktop and laptop alike. And while the Predator is fast, at 289MB/s read and 168MB/s write, it's not quite the speed demon the name might suggest... and that the whopping price might deserve. A tough metal keyring helps increase the value some, but considering you could buy three of the ThunderDisks at left for the price of just one HyperX Predator, we know what option we'd choose.

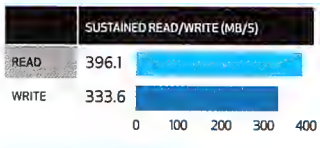
Verdict

Kingston's Predator offers a ton of storage, but its very large and more than a bit overpriced

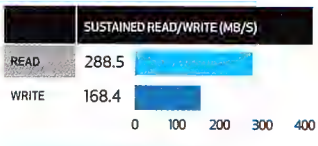
★★★☆☆

LABS BENCHMARK RESULTS

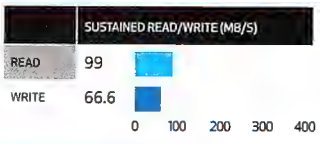
BLUEEYE THUNDERDISK PRO 256GB



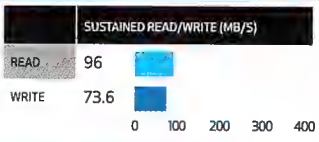
KINGSTON HYPERX PREDATOR 512GB



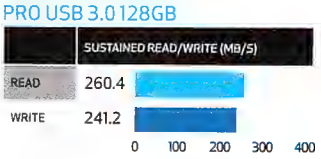
LEXAR JUMPDRIVE S33 128GB



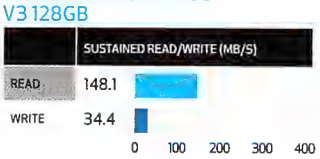
TRANSCEND JETFLASH 790 128GB



SANDISK EXTREME PRO USB 3.0 128GB



VERBATIM STORE'N'GO V3 128GB



$105 | AU.LEXAR.COM

Lexar JumpDrive S33 128GB

HAS A NIFTY CAPLESS DESIGN, BUT THE SPEEDS ARE JUST AVERAGE.

Lexar's JumpDrive is a bit of an old-school design, but one that's quite functional. It's got two parts – the white bit is the key itself, and the black section swivels around this, acting as a kind of cap to protect the USB connector. And the latter recesses back in when you swivel the black section around, so this is a very compact key when closed. The plastic housing doesn't quite feel as tough as the Verbatim, but it was a little better than the Transcend. Speed-wise it was actually pretty close to the latter though, with 99MB/s reads and 67MB/s writes. This isn't a bad key by any measure, but we'd be tempted to spend a little more for the extra speed found elsewhere.

Verdict

Not bad in terms of speed and we dig the swivel-cap design, but it doesn't stand out otherwise.

★★★☆☆

$119 | AU.TRANSCEND-INFO.COM

Transcend JetFlash 790 128GB

MIDDLE OF THE ROAD IN TERMS OF SPEED, BUILD QUALITY AND PRICE.

Transcend's plastic USB key isn't the sturdiest feeling – compared to the Verbatim right (which has thicker gauge plastic) the Transcend doesn't feel like it could take as much physical punishment, so if you want a key with a bit of ruggedness, it's best to look elsewhere. In terms of performance, the JetFlash 790 was middle of the road – 96MB/s reads and 74MB/s writes. That's a better balanced than the aforementioned Verbatim – and significantly faster than what you'll see on a USB 2.0 flash drive – but nothing noteworthy in the company of the other drives here. The JetFlash 790 range hadn't quite hit the Australian market at the time of testing, so the price quoted above is RRP.

Verdict

Doesn't feel as tough as some other plastic keys, and could use a bump in speed at this price.

★★★☆☆

$180 | WWW.SANDISK.COM.AU

SanDisk Extreme Pro USB 3.0 128GB

A MOSTLY CLASSY AFFAIR, WITH GOOD SPEEDS AND A TOUGH METAL CHASSIS.

At this 128GB size, SanDisk's option is a little more pricey than most others, but there is some justification for it. Its body is made up of a metal shell that wraps around a plastic slider; the latter flicks the USB connector in and out. Despite being the biggest 128GB key, we'd be far more comfortable sticking this one on our keyring thanks to the loop being metal. And its performance was excellent for both reads and writes at around 260MB/s and 240MB/s, respectively. Our only real gripe here is that the sliding mechanism can be a bit sticky. Still, that's better than it being too loose – and retracting when you're trying to plug it in. If you need speed though, this one's got the goods.

Verdict

A great combination of speed and a tough metal chassis, but shop around for the best price.

★★★★½

$95 | WWW.VERBATIM.COM.AU

Verbatim Store'n'Go V3 128GB

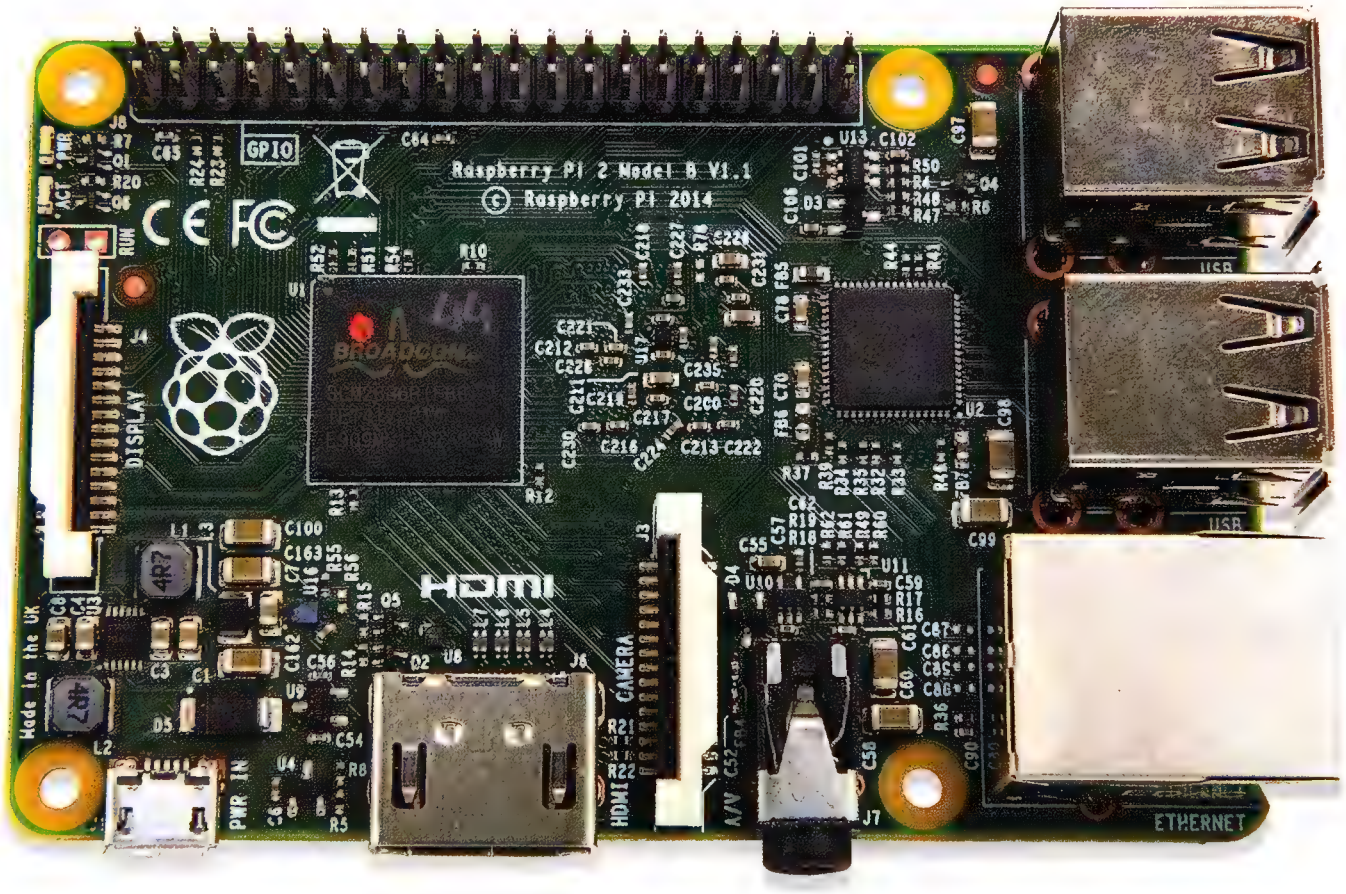
LOW PRICED, BUT A BIT WOBBLY IN TERMS OF FEATURES AND PERFORMANCE.

One of the more sedate-looking models Verbatim's was also the least-expensive in this test, at well under $1 a gig. Yet it includes a lifetime warranty against manufacturing defects – meaning if it just up and dies (and you haven't treated it like a piñata) Verbatim'll replace or repair it. You do get what you pay for in one respect, however, and that's write speeds which, at just 34MB/s, were the slowest here. That means it's not great for doing backups on the run – although getting files off is still reasonably speedy, at 148MB/s read speeds. What's also a tad annoying is that if you loop a keyring through the hole at the back of the slider, you can't actually slide the whole USB connector out.

Verdict

The performance is a bit imbalanced, but it's hard to argue with the value on offer here.

★★★½☆



Hands-on with the Raspberry Pi 2

Les Pounder has early access to the first batch of Raspberry Pi 2s and takes one for a test drive.

The new Raspberry Pi comes with much more power than it's predecessors. This is thanks to the improved ARM 7 processor running four cores at 800MHz each and the generous 1GB of RAM. This increase in both CPU and RAM is a massive benefit to projects that require pure CPU grunt, such as OpenCV and *Minecraft*.

The Raspberry Pi 2 also benefits from the design improvements made for the B+ with more USB ports thanks to the LAN9514 providing four ports over the 9512's two. The B+ also introduced better power management and this, again, is also present in the Raspberry Pi 2. "Power consumption while performing a given task is comparable to that of B+," explains Eben Upton, CEO of Raspberry Pi Trading. "Obviously if you push Pi 2 hard it will consume more power as it's doing more work. Power consumption of B+ under heavy load is roughly the same as the old Model B."

So now that we have the latest Raspberry Pi, lets take it for a test drive! And for this feature we will be using the latest version of Raspbian available via the Raspberry Pi web site (**www.raspberrypi.org/downloads**) as it comes with the kernel7.img necessary to use the ARM7 CPU.

The easiest method to setup your microSD card is to use *NOOBS* (New Out Of The Box Software) To use it you will need at least an 8GB microSD card. Download *NOOBS* as an archive from the Raspberry Pi web site and extract the contents to your 8GB microSD card which should be formatted to use a FAT32 filesystem. With NOOBS copied to your microSD card, unmount and remove the card from your computer and insert it into your Raspberry Pi 2, you should hear a gentle click once it is firmly in place.

Connect your Raspberry Pi to a monitor via the HDMI port and then attach a keyboard and mouse via the USB ports. You will also need to ensure that you have internet access for your Pi. The easiest method is to use the Ethernet port. Finally, attach the power supply to the micro USB port. Your Raspberry Pi 2 will now boot for the first time.

"The Raspberry Pi 2 also benefits from the design improvements made for the B+."

On first boot *NOOBS* will ask you which OS to install, in this case we require Raspbian. Select the OS and start the installation, which will take around 10 minutes.

With the install complete the Pi will reboot and start Raspbian for the first time, and the first thing that you will notice is how quick the boot process is now at 17 seconds versus 33 seconds for the B+! For the observant you'll also note that there are now four raspberries at boot up. This denotes that the Raspberry Pi 2 has four cores, a rather nice little Easter egg that harks back to the old boot screens of Linux distributions. Once booted we are immediately presented with the raspi-config menu, this is a tool to further configure your Raspberry Pi. At this stage we will simply exit out of the menu and login as normal. The standard login details have not been changed and remain as:

```
USERNAME: pi
PASSWORD: raspberry
```

Once logged in you need to type `startx` to load the desktop. You'll see that the desktop is a little different to previous versions of Raspbian, this is due to extensive changes that were made by the Foundation back in December of 2014 and is largely the work of Simon Long, who used to work for Broadcom. In fact, it was Long who hired Eben Upton at Broadcom, but now Simon Long has joined the Raspberry Pi Foundation to work on the user interface and his first project was to develop a new desktop.

The Raspberry Pi Foundation have created a very powerful single board computer, but how can we test that power? It is somewhat fitting that we can calculate Pi to as many decimal places as we wish, so lets say 10,000? To do that we need to install some software, first. Open LXterminal and type the following two lines:

```
sudo apt-get update
sudo apt-get install bc
```

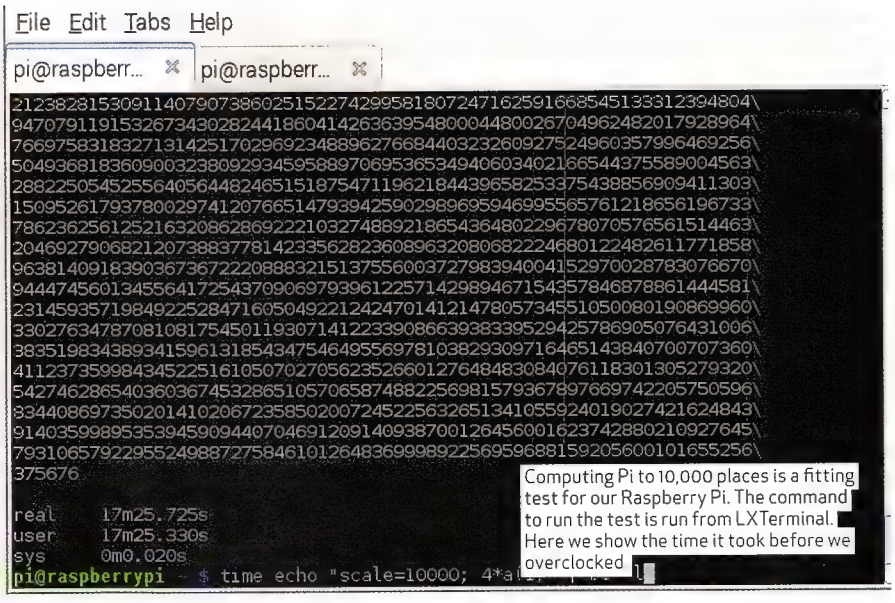
We've just installed a precision calculator that we can use from the terminal. So now to the test, calculating Pi to 10,000 places and timing the activity.

```
time echo "scale=10000;
4*a(1)" | bc -l
```

In our test it took 17 minutes 25.725s to calculate Pi to ten thousand decimal places on our stock Raspberry Pi 2. We repeated the same Pi test on a Raspberry Pi B+ and it took significantly longer at 25 minutes 5.989 seconds to perform the calculation. As you can see straight away that's a very clear indication that the processor of the new Raspberry Pi 2 is easily much more powerful than previous models we've seen.

Our quick test, gives us a good idea of how much of a serious performance beast the Raspberry Pi 2 is out of the box, but can we tweak it into more of an animal? Well, earlier we dismissed the raspi-config menu but for this next step we need it again. In LXTerminal, and type the following:

```
sudo raspi-config
```


File Edit Tabs Help
pi@raspberr...
pi@raspberr...
real 17m25.725s
user 17m25.330s
sys 0m0.020s
pi@raspberrypi ~ $ time echo "scale=10000; 4*a
Computing Pi to 10,000 places is a fitting test for our Raspberry Pi. The command to run the test is run from LXTerminal. Here we show the time it took before we overclocked

TURBO CHARGE YOUR PI

Our first post install configuration is to review the memory split. This is how the memory is divided between the GPU (Graphical Processing Unit) and the main system. On the Raspberry Pi a typical setup would be around 64MB of RAM for the GPU and the remaining RAM would be allocated to the system. This is an optional config tweak but you could just leave it as is. You can easily tinker with these values, and a general rule is that a terminal will not need as much RAM as the full desktop, so for a terminal-only project you can easily get away with 6MB allocated to the GPU. For desktop applications such as *Minecraft* a minimum of 64MB is needed. You will be prompted to reboot your Raspberry Pi, do this and you will be returned to the login prompt.

With the changes made to the memory split now let us return to the raspi-config main menu and head to the Overclock menu. Your Raspberry Pi 2 already runs at 800MHz per core, which is an improvement over the original 700MHz single core ARM 11 CPU. We spoke to Eben Upton and Gordon Hollingsworth about the new CPU and they both confirmed that it can be overclocked to around 1.1GHz per core. We won't be going quite that high, but we will overclock our Raspberry Pi to a

Ubuntu on Pi?

The biggest surprise brought about by the new Raspberry Pi 2 is compatibility with Ubuntu for ARM 7 CPU. Before the original Raspberry Pi was released in early 2012, Ubuntu was often mentioned as a candidate for the Pi, but as Canonical didn't support the ARM 6 architecture, which the ARM 11 CPU used in the original Pi, another distro was needed. Early on we saw Pidora, a fork of Fedora for the Pi, being used to demonstrate the power of the Pi. But Pidora brought a full desktop experience to hardware that required a lighter distribution. After further investigations Debian, in the form of Raspbian, was seen as a suitable candidate and this remains the official distro and is used for all official tutorials and supporting documentation.

But compatibility with Ubuntu doesn't mean that the Foundation is abandoning Raspbian: "We're not planning an official Ubuntu image," says Eben Upon. "We're going to benchmark 'regular' armhf Debian against Raspbian, and may switch if we see a compelling performance advantage. Our preference is to stick with Raspbian, perhaps with a few key libraries swapped out dynamically, as this will allow us to support Raspberry Pi 2 and Classic from the same image."

At the time of writing there are no ready made images for Ubuntu on Pi, but over the coming months there are sure to be many on offer for you to try. including Ubuntu Core.

stable 900MHz using the Overclock menu. While this is a relatively safe activity it should be noted that going too far with overclocking can severely damage the CPU due to the excessive heat generated by it working harder.

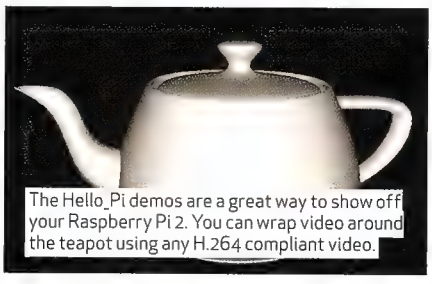
We asked the Raspberry Pi team and it confirmed that the core can reach temperatures of 85 degrees, and when it does it will automatically turn off the Raspberry Pi for protection. For 'extreme' tinkerers who want to push their Raspberry Pi 2 to the limit, now might be the time to invest in a set of heat sinks. If at anytime you wish to return the CPU to it's normal speed, re-enter the raspi-config menu and return the values to the stock 800MHz.

With our configuration changes made, and after a few reboots we have successfully 'turbo charged' our new Raspberry Pi. Let's start the graphical user interface. After logging back in use the LXTerminal to type: `startx` to return to the desktop. Now, lets see how the changes have improved our Pi to 10,000 score by repeating the test. Open LXTerminal and repeat the test code which was

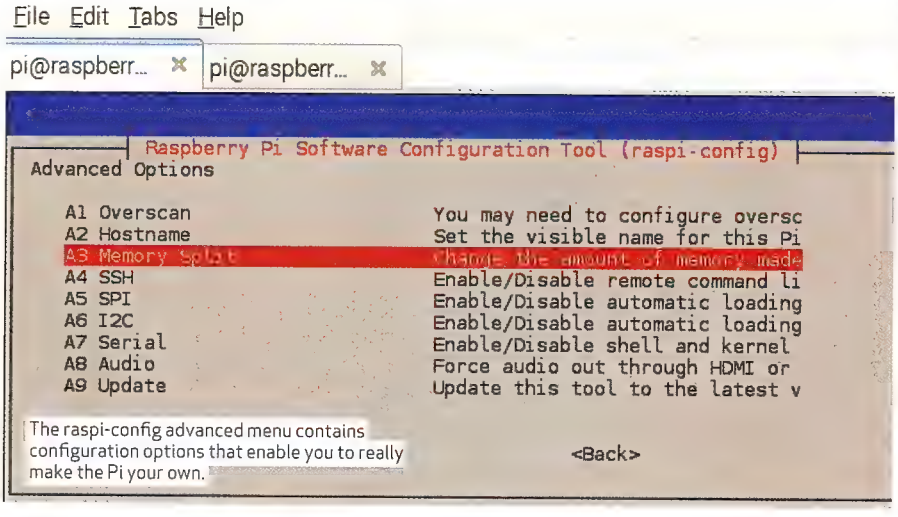
```
time echo "scale=10000;
4*a(1)" | bc -l
```

The code will run and in our test it took 15 minutes 28.519 seconds – that's an improvement of two minutes!

The Raspberry Pi Foundation has taken great care to build upon the legacy created by the Raspberry Pi Classic: "Raspberry Pi 2 has been in development for a couple of years," say Upton and Hollingsworth, and that includes the time spent developing BCM2836. "The first silicon arrived at the start of last May; there will be a video on the blog of me, James and Dom in the lab at Broadcom at 1am, the day after silicon came back, with the 'video on a teapot' demo running from Linux on a Broadcom "Ray" dev board. The design of the Rasberry Pi 2 board started last August (2014), and we've had samples since October (2014). We went through three iterations of prototypes to get exactly the right performance," says Upton.



The Hello_Pi demos are a great way to show off your Raspberry Pi 2. You can wrap video around the teapot using any H.264 compliant video.



The raspi-config advanced menu contains configuration options that enable you to really make the Pi your own.

COMPATIBILITY

The performance is reflected in the choice of CPU for the Raspberry Pi 2. Rather than choose another architecture the Foundation has stuck with an ARM-based CPU that is compatible with the ARM11 found in the earlier Raspberry Pi. The quad-core ARM7 can run software written for the older Raspberry Pi: "Raspbian works out of the box, but requires a new v7 kernel, which will be included in the downloads from our web site" said Eben.

As for hardware compatibility, the Raspberry Pi 2 shares the same GPIO as the B+, which means that boards made for the A+ and B+ will also work with the Raspberry Pi 2 and this even includes HAT boards (Hardware Attached on Top), which contain an onboard chip that communicates with the Raspberry Pi to set up the board quickly.

There are some boards, however, that are not compatible with the B+ and the Raspberry Pi 2 due to their size and design. Boards such as PiFace and PiFace Control and Display – that was used to control a camera rig for the Royal Institution Christmas Lectures (**tinyurl.com/mx9eg9w**) – cannot be attached. But the OpenLX SP team behind these boards has released special versions for the B+ and Raspberry Pi 2.

3D GRAPHICS TEST

Every Raspberry Pi comes with the same VideoCore IV GPU that enables the Raspberry Pi to play back high-definition video at 1080p. The new PI also comes with this GPU, also made by Broadcom just like the BCM2836 powering the new Pi. Did you know that there's a test suite for the GPU?

You can find the test suite by opening LXTerminal and typing the following:

```
cd /opt/vc/src/hello_pi/
```

In there you will find a number of

The making of Raspberry Pi 2

The Raspberry Pi Foundation are rather excited about the new Raspberry Pi 2, We spoke to the engineering team and Gordon Hollingsworth about development: "The Raspberry Pi 2 is 100% awesome. It's as close to a typical PC as we wanted when we first started the project." And the amount of effort that's gone into development is impressive: "The team have put the equivalent of 20 years of work into the new Raspberry Pi and it's processor, and that runs at a cost of between $2-3 million." But there's still a lot of enthusiasm for the older Raspberry Pi, Eben Upton explains: "There are a lot of industrial customers who won't want to switch, and, of course, we still have the Model A+. To give you an idea of the 'stickiness' of an old platform, we sold something like 80,000 Model Bs after the Model B+ launch."

The Foundation also has its Compute Module, which was created to embed the Raspberry Pi inside industrial applications. We asked Eben if the Compute would be seeing a similar upgrade or not: "We'll do a Compute Module 2 at some point, but probably not in the first half of 2015."

And what of the A+? Would there be a similar upgrade for it: "Nothing is currently planned as the A+ price point is quite challenging." No upgrade for now then, but the Raspberry Pi family has grown considerably since 2012 and now features six devices.

directories containing many different demos. But before we can use them we need to build the demos from source, and to make this easier the Foundation have provided an automated build script that will only need to run once. To run the script, in LXTerminal type

```
./rebuild.sh
```

This build script will run the build process for all of the demos so it may take a few minutes, even on our new speedy Raspberry Pi.

Once completed there are a number of demos that you can try out and the first on the list should be hello_teapot. To run it, in LXTerminal make sure that you are still in the hello_pi directory and type:

```
cd hello_teapot
./hello_teapot.bin
```

You will now see a 3D render of a teapot with video that's been directly rendered on to its surface. To exit out of the teapot demo hold 'Control-C' together and you will be returned to LXTerminal.

Another demo to try is hello_triangle2 and to getto that you will need to go back to the hello_pi directory and we can do that by typing.

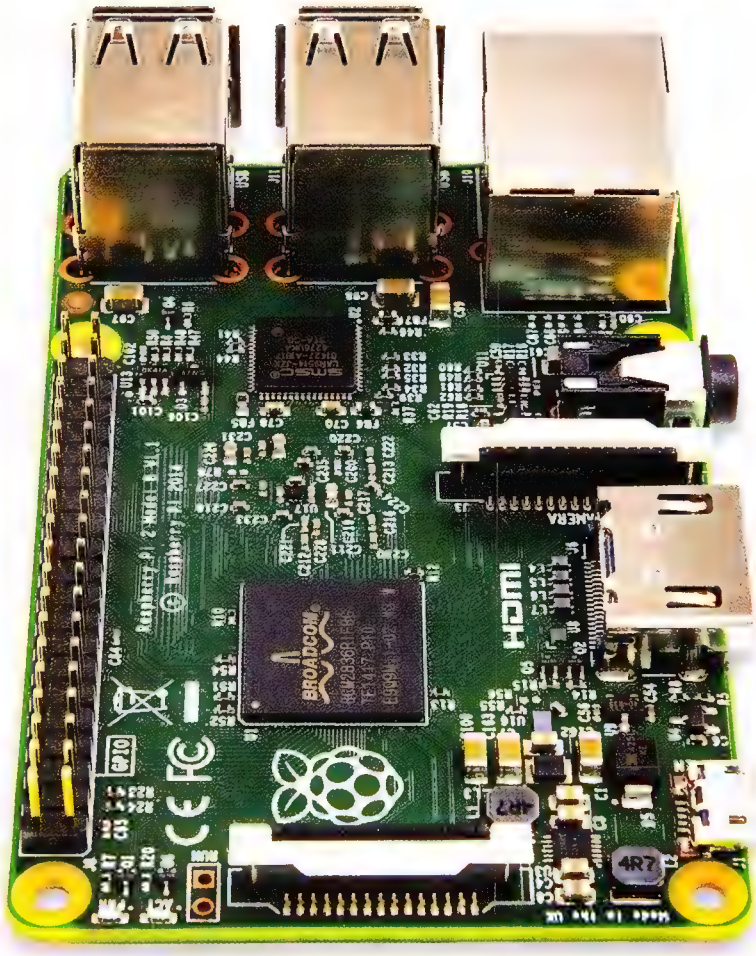
```
cd ..
```

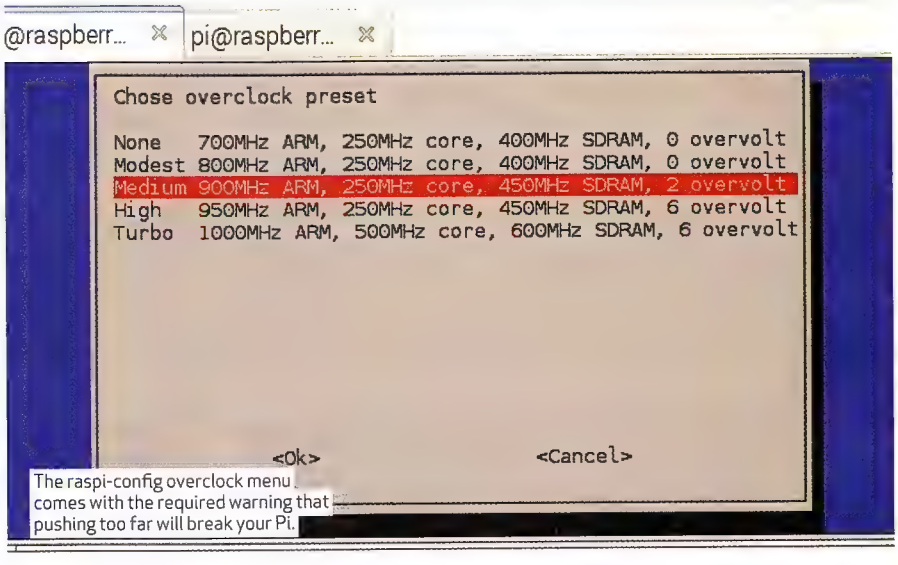
From hello_pi we can change our directory to hello_triangle2 and run the demo by typing

```
cd hello_triangle2
./hello_triangle2
```

This demo appears to be rather static at first, but try moving the mouse around and you will see two fractals superimposed one over the other moving and reacting to your mouse movements. Apparently, you can also control the fractals to create a perfect circle. To exit out of the hello_triangel2 demo hold 'Control-C' together and you'll be returned to LXTerminal.

So we've taken a look around the new Raspberry Pi 2, seen how it performs out of the box and taken time to supercharge our Pi. On the next page we will interface *Minecraft* with Pibrella to create a pushbutton bomb deployment system.




@raspberr...
pi@raspberr...
Chose overclock preset
None 700MHz ARM, 250MHz core, 400MHz SDRAM, 0 overvolt
Modest 800MHz ARM, 250MHz core, 400MHz SDRAM, 0 overvolt
Medium 900MHz ARM, 250MHz core, 450MHz SDRAM, 2 overvolt
High 950MHz ARM, 250MHz core, 450MHz SDRAM, 6 overvolt
Turbo 1000MHz ARM, 500MHz core, 600MHz SDRAM, 6 overvolt
<Ok>
<Cancel>

The raspi-config overclock menu comes with the required warning that pushing too far will break your Pi.

Updating your Pi

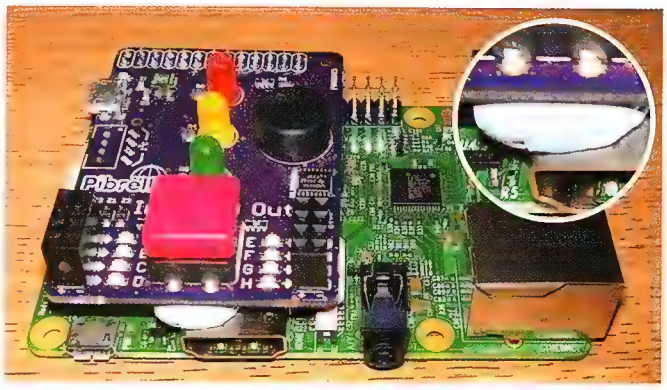
The Raspberry Pi Foundation has released many new updates to the existing Raspbian install and keeping your Raspberry Pi up to date is a really good practice. There are a few handy Terminal commands to help you, such as: `sudo apt-get update` which will update the list of installable software. Using the following: `sudo apt-get upgrade` will check for the latest software, while: `sudo apt-get dist-upgrade` is similar to upgrade, but a more intelligent updater that removes old kernels.

If you would like to install the new desktop, and who wouldn't as it is a really great piece of work by Simon Long, type the following three lines into a terminal:

```
sudo apt-get update
sudo apt-get dist-upgrade
sudo apt-get install raspberrypi-ui-mods
```

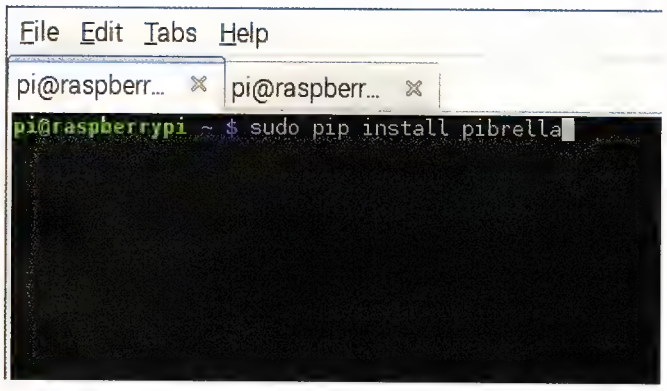
Once completed, reboot your Raspberry Pi for the changes to fully take effect. Once logged back in you will be greeted with the new and improved interface. Updating is done via the terminal using the very powerful apt package management system that's used by all Debian-based distributions.

Link a Pibrella to Minecraft



1 ATTACH PIBRELLA TO YOUR RASPBERRY PI

We'll use the big red button on the Pibrella.com to set off TNT in Minecraft. The Pibrella fits over the first 26 GPIO pins. Never attach while the power is on! Use a blob of blu tack or modelling clay to prevent the underside shorting out the HDMI. Now connect the other cables as usual, but insert the power into the micro USB port.

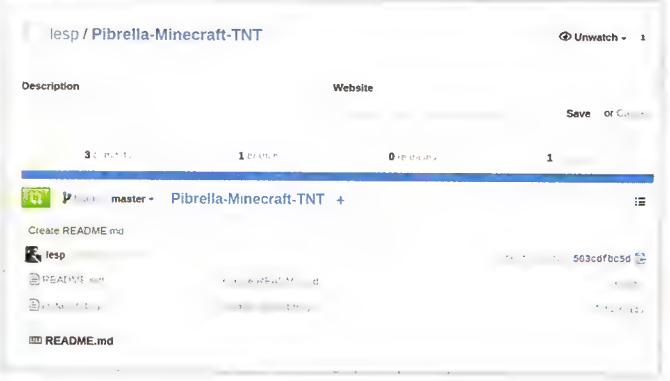


2 SETUP PIBRELLA

With our Pi booted to the desktop, open LXTerminal and type:

```
sudo apt-get update
sudo apt-get install python-pip
sudo pip install pibrella
```

This installs the software that we need to use Pibrella with Python.



3 GET THE CODE

We've created a zip file that contains the code for this tutorial, so visit **www.apcmag.com/magstuff** and download a copy. Next open LXTerminal and type: `sudo idle`

This opens idle, a Python editor, with elevated privileges enabling us to use Pibrella with Python. Now open the example code.

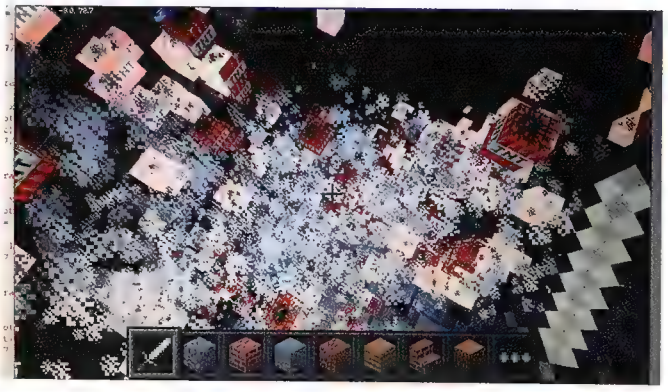
```
import mcpi.minecraft as mi
#We import the Minecraft mo

mc = minecraft.Minecraft.cr
#We create a connection bet

#We define a function and c
def button_changed(pin):
```

4 EXAMINING THE CODE

Our code is written in Python 2 as the *Minecraft* module is currently only available for that version. The code is fairly easy to read. Note the line starting with # are comments. The first few lines are imports, they import extra functionality, in the form of Pibrella and *Minecraft* libraries, for our project. After that we use a variable called mc to store connection details to Minecraft.

5 IN POSITION

Minecraft uses x, y, z coordinates to know the position of objects in the world. We create a function called button_changed(), which locates the player and then creates a cube of TNT at coordinates near to the player. Lastly we set the function to be called when the button is pressed. Keep the window open and open *Minecraft* and create a new world



6 DROP THE BOMB

With *Minecraft* ready and our code open, press TAB to release the mouse from *Minecraft* and click on 'Run > Run Module in idle'. The idle shell will come to life and run the code. Switch back to *Minecraft* and go to a nice spot. Press the red Pibrella button to drop the bomb. Hit the TNT with your sword... and then RUN! Note: You can run this on the original Pi, but it could crash *Minecraft*. ■

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NEW HORIZONS

A new wave of first-person adventures is trading action for discovery. We talk to the pioneers of a genre to find out where it's headed next.

By Anthony Agnello

Conflict lies at the heart of a great many videogames, but nowhere more so than in those that adopt a firstperson perspective. In the period between 1992's *Wolfenstein 3D* and 2014's *Wolfenstein: The New Order*, the word 'shooter' has become the natural partner for 'first-person', so successful has the genre been. But there's a growing counterculture of developers putting the emphasis on what you can do with an eye-level camera without tying it to the extensions of a vehicle or firearm.

FROM TOP Steve Gaynor, writer and designer of Gone Home; William Pugh, writer and designer of The Stanley Parable

"There's definitely a bit of a moment going on with these kinds of games," says The Fullbright Company's Steve Gaynor, designer of house-bound interactive mystery *Gone Home*. "There's a lot of games that gave us the confidence to make a game like *Gone Home*, games such as *Dear Esther*, and even *Amnesia* or *Portal*. There was this small movement of games before we came out that were starting to explore FPSs where they're shooting, but you're asking what else is going on."

Gaynor worked on one of the latter himself: *BioShock 2's Minerva's Den* DLC. "We saw isolated examples that could be expanded on," he says. "That's where *Gone Home* came from. We played a bunch of games based on environmental storytelling with audio diaries and stuff as a side activity, as a small support structure for the core loops of combat and levelling up, and we were like, 'Well, what if that was the whole game?' We see people saying the first hour of *Bioshock Infinite* was their favourite game in recent memory before the combat started. That has to build up before people say, 'All right, what if the first hour of *Bioshock Infinite* was the whole game? How do we make it interesting? How do we invest additional mechanics into making it the thing that you do, not just the prelude to an FPS?"

"WHAT IF THE FIRST HOUR OF BIOSHOCK INFINITE WAS THE WHOLE GAME? HOW DO WE MAKE THAT INTERESTING?"

Gone Home is just one of the first-person adventure games from the past year that has attracted critical acclaim – and a tsunami of internet scorn – for embracing the design extremes touched on by post-*Portal* experiments such as *Dear Esther*. *Gone Home* strips away first-person norms, eschewing fighting, shooting and taxing environmental puzzles. It doesn't even have the idiosyncratic, multistep puzzle solving of point-and-click adventures. And it isn't the only game seeking to chart this space.

While Fullbright was hard at work on *Gone Home*, *Galactic Café* was finishing up *The Stanley Parable*, a surreal and self-aware adventure that shares the same conflict-free structure as *Gone Home*. White Paper Games, meanwhile, skipped the human drama of *Gone Home* and the Dadaist musing of *The Stanley Parable*, building its own actionless adventure in *Ether One*, an impressionist tale about living with dementia. Released within six months of each other – while the major FPS machines at Activision and Electronic Arts revved up for a new console generation – these games represent a relatively new avenue for creators. Vekla's *The Witness*, The Chinese Room's *Everybody's Gone To The Rapture* and Storm In A Teacup's *Nero* pave the way for some of this actionless genre's next steps.

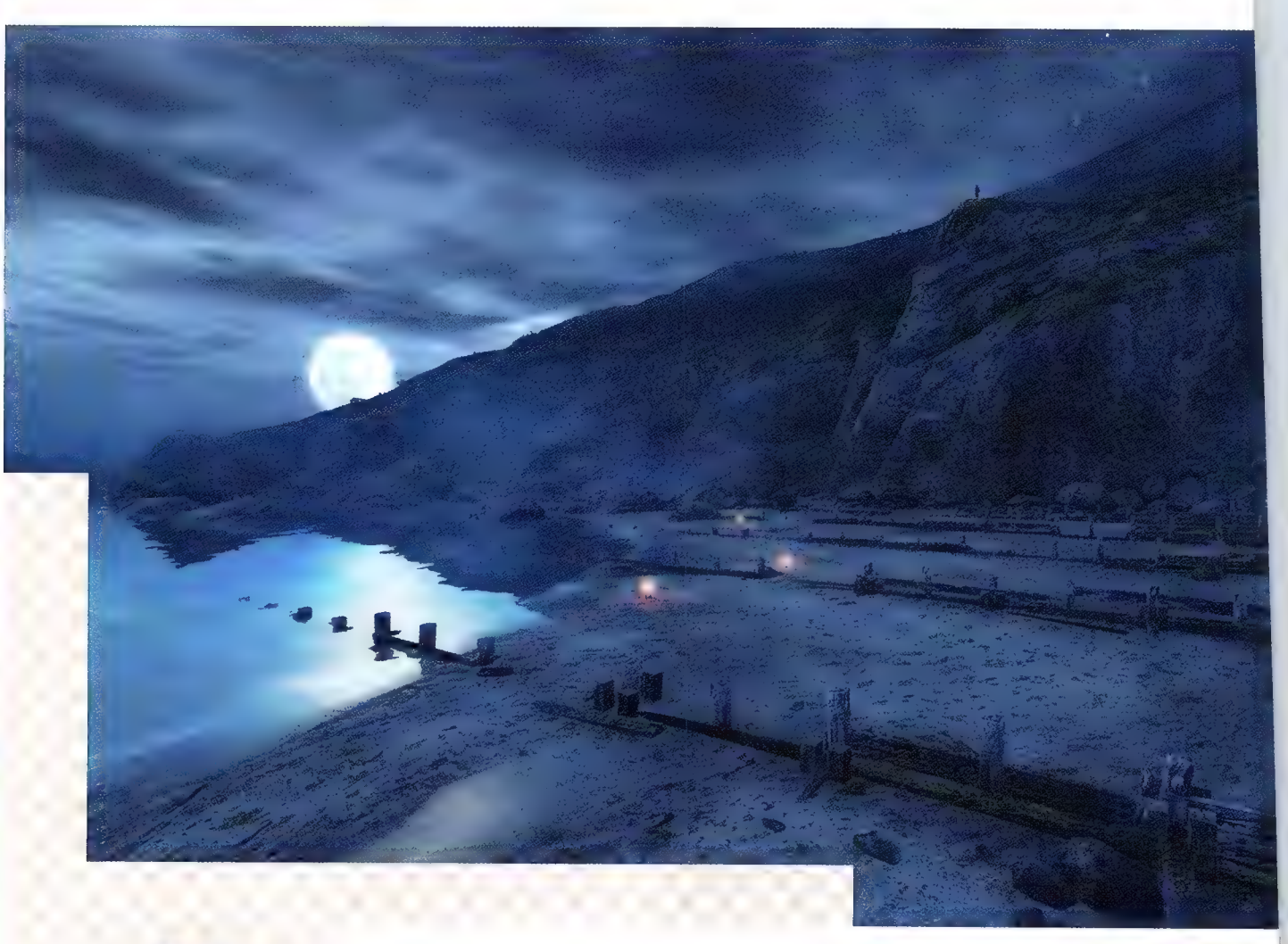
In place of action, these games share a set of defining characteristics. They're all mysteries solved through observation and slight manipulation of the environment. You might pick up a key or a lantern, or press a button to reveal more space. They're also all lonely experiences, largely devoid of other characters. Yet

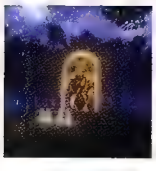
FROM THE SOURCE

Dear Esther shares crucial history with *The Stanley Parable* — both games were born as *Half-Life 2* mods. The ease of use, low cost and accessibility of Valve's ageing but versatile engine has played a significant role in games like these being made.

"You've got the Unreal Engine, CryEngine, Unity and Source," says White Paper Games' Pete Bottomley, reflecting on the tools available to designers looking to build a 3D game. There are plenty of options, each with their merits, but Source is unusually rich with finished games ready to be modded, which makes experimenting with ideas far easier. "You've got *Unreal* and, yes, you can mod it in software and stuff like that, but the thing about the Source engine is it comes with the *Half-Life*-style game design approach and so there's very much an emphasis on storytelling. It's already got those kinds of elements in there that allow you to create a narrative-driven game."

TOP Gone Home's Greenbriar mansion is overfull with conflicts both real and implied, but not a single one requires stealth kills or headshots. RIGHT The Stanley Parable asks the player to make seemingly the most passive of decisions – go right when told to go left – but these small, docile actions lead down an array of existentially harrowing paths





TOP Dear Esther's haunting coastline is a realisation of the promise glimpsed beneath the surface of the Source-powered game that served as its foundation. RIGHT Ether One's Restorers work in an office that's the ideal home for boxes of ammo and health packs, but the familiar hi-tech setting is just a gateway to the fractured minds they're trying to fix

"GONE HOME IS THE WAY IT IS BECAUSE THEY DIDN'T HAVE THE RESOURCES TO DO ANYTHING WITH CHARACTERS"

despite these shared features, it's hard to say what this burgeoning genre should be named.

"First-person narrative exploration game?" suggests one of the primary masterminds behind *The Stanley Parable*, William Pugh. "I don't know. I know that we certainly didn't create this seeing a genre emerging and thinking we could do something within that. The game very much emerged from limitations we had when designing it, and I guess that's why you see so many independent studios doing this sort of stuff, possibly, rather than people with more money to spend on AI and mechanics."

In *The Stanley Parable*, you control an office worker who finds his workplace suddenly abandoned. A narrator explains Stanley's actions before you act them out, but you're regularly presented with the chance to defy the script, resulting in drastically different endings and storylines. Follow the narrator's path, and you may find a depressing dissertation on the banality of fantasy. Try to spice things up by jumping from a stock-room elevator to a hallway below, though, and you'll be treated to a teardown of the average player's ceaseless need for competition and thrills. The narrator even plops a leaderboard into the game and lets you press a big red button, saying such focus-grouped features make *Parable* more marketable. These sequences are hilarious and rewarding as discoveries, but they also get to the heart of those limitations described by Pugh. They're mysterious and lonely, partly because they have to be.

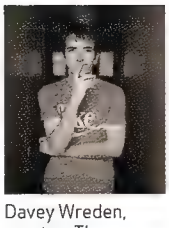
"*Gone Home* is the way that it is because they just literally didn't have the resources to do anything with characters," Pugh's partner and the creator of the original Source engine mod version of *The Stanley Parable*, Davey Wreden, says. "For a lot of independent developers, you can go in a completely divergent direction and pull it off as opposed to doing what the big developers are doing, and it never even succeeds. If we had a big budget, I guess we would have had NPCs and we would have had the freedom to make more choices, but those might not have been good choices."

WHEN A GAME ISN'T A GAME

"When Steam launched its tagging mechanism so you could add tags to games, we ended up in the 'Not a Game' category," says Gaynor, annoyed but also with a sense of humour about the public backlash against this breed of firstperson adventure. For as much critical and sales success as these games have enjoyed, they've drawn an equal amount of hate. Why all the fuss?

"It's threatening, right?" says *Gone Home* co-writer and artist Karla Zimonja. "People have spent how many decades or years learning how the normal games work and all of a sudden it's not applicable, and 'God! It's [not] about winning, and it's about women, and I hate that!' But you know, there's so many cool places you can put challenge in games. We chose to put it chiefly in comprehension and understanding, and that is not where a lot of games put it, so [*Gone Home* is] unfamiliar, strange and threatening."

"PEOPLE HAVE SPENT HOW MANY DECADES OR YEARS LEARNING HOW THE NORMAL GAMES WORK AND ALL OF A SUDDEN IT'S NOT APPLICABLE"



Davey Wreden, creator, *The Stanley Parable*

***Dear Esther* has sold well over 750,000 copies, *Gone Home* sold 250,000 copies over its first four months, while *The Stanley Parable* sold more than 100,000 copies in its first week. *Ether One*, released in March 2014, has reviewed well with the majority of critics, with a score of 81 on Metacritic. The secret to success is specificity, according to White Paper Games developer Pete Bottomley.**

"You're not trying to cater to everyone, [and] I think that's really important," he says. "We asked, 'What's the genre? What's your intended audience?' All the general questions. We just kind of made what we wanted to play and then we put it out there. All of the triple-A games have to sell millions of copies, so they've got to appeal to quite a lot of people. The reaction's never going to be as [polarised] as 'This is a real interesting experience' at one end versus 'This is a walking simulator' at the other."

Putting you in the role of a Restorer, someone who dives into the mind of dementia sufferers and attempts to fix their minds, *Ether One* is more active than many of its peers. Items such as a lantern have to be used in puzzles to unveil more of the story, but most of these puzzles can be skipped entirely and don't require any bold interactions. Rather than the domestic landscape of *Gone Home* or the preposterous, shifting office of *The Stanley Parable*, *Ether One* switches between environments meant to evoke a dementia patient's mental landscape, moving between a sterile clinic setting, a forbiddingly drab series of industrial locales, and a technicolour cel-shaded world called Pinwheel. *Ether One* treads that fine line between what internet pundits have lambasted as 'walking simulators' and something that is still recognisably a traditional game with obstacles to overcome.

"It's hard when you're dealing with subject matter such as dementia, because you want it to be a serious game, but you don't want it to be a serious game that's dry," says Bottomley. "We tried to always tie back into dementia, but as far as pacing goes, we still wanted those, you know, 'triple-A-style' experiences. We have a co-narrative that sets the overall pace for the game: collecting

ribbons. It makes 70% of the game optional. It was a difficult decision, I'll tell you that, because it's very game-y, that mechanic, but that was the best way that we could set the tone and the pace of the game."

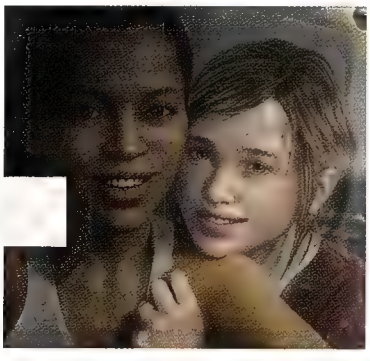
"With our game, it's all about the interaction with this other entity, the narrator," Pugh says, attempting to pin down *The Stanley Parable's* appeal. "A kind of satisfaction comes from a conversation between the player and the game. The gameplay takes place within your mind rather than in the game. We do it a bit in the sense that the player has to kind of work out what this system is that they're inside of."

While *The Stanley Parable's* authorial control is clear, the designers of *Ether One* and *Gone Home* prefer to maintain the integrity of the fourth wall. "It was a good idea to primarily have the house be behaving like a house would in the real world," Fullbright artist Karla Zimonja says. "We didn't really want it to be like, 'I went to Disneyland and I went into the Ghost House, and there's things happening every time I step around the corner.' If you got too tricky with the reactions to the players' behaviour, it started feeling very constructed and it didn't feel good."

"Our intent was to have as light a touch as possible and only intervene as the designer as the presence of the person that built the game in very specific circumstances," Gaynor says. "We wanted to approach a sink as a sink. You can turn on a sink and turn it off because you can [in real life]. Similarly, we do not put down trigger volumes that say, 'Lightning flash one happens when you walk through door A.' It's more like lightning and thunder could be out there just happening any time and its unpredictable the way that nature is unpredictable."

Crucial to the success of all these games is freeing the player to explore unimpeded. Free of all but the most limited guides and tutorials, these actionless adventures thrive on trust. "I don't think that you can respect your player enough," Wreden says. "You have to imagine that they actually will go off and want to do work on their own to unravel this thing that you've created, that they're willing to go the distance. At the same time, it's really hard to do all of this work and then just leave people hanging, to not resolve something, or to risk that a lot of people just won't find something that you've spent a lot of time on. Allowing stuff to be hidden – that goes a lot of the way toward cultivating respect with your players to where they feel they're engaged. [I believe] that you as a player are smart enough to both want to do that and to be able to actually make the actions on your own."

The question now is how the actionless first-person adventure evolves. Vekla's *The Witness* looks to further explore the ideas shared by these games, but over a



significantly longer runtime. *Gone Home, The Stanley Parable* and *Ether One* are all brief experiences – just a few hours long to complete in their entirety – while Vekla's Jonathan Blow has said his team has found *The Witness* to take 25–40 hours to finish. Whether the mainstream blockbuster publishing machine embraces this style depends partly on its success, on whether such games can be made into longer experiences players are inclined to spend larger sums of money on.

"I want to see more different, interesting things happening in all sections of the industry," Gaynor says. "I think it would be really fascinating to see what happened if a game with a full triple-A budget gave themselves those same constraints: like,

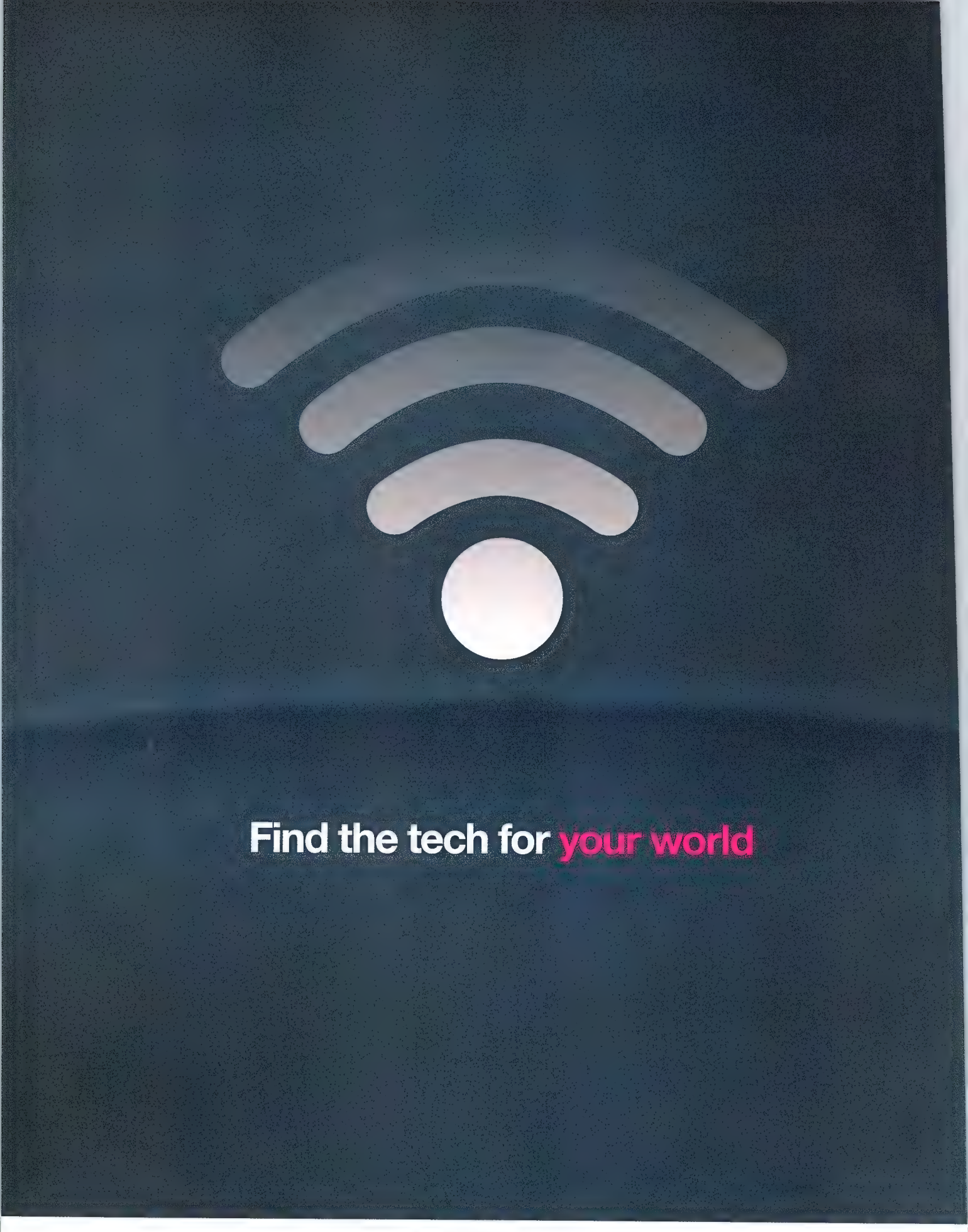
there's no attacking in this game whatsoever. I really liked what Naughty Dog did with the non-combat sections of *The Last Of Us* DLC where Ellie and Riley were running around together, letting the player's play be about character building and a deeper understanding of the world... not as a means to killing zombies. But it could also be done badly, you know? There's a reason *Gone Home* is only three hours long. We don't know if a 20-hour game works in this format and I don't know necessarily what you would add to it to make it stand alone. I don't know if that can sustain an entire production, but it'll be an interesting thing to see."

BIGGER EQUALS BETTER?

The economic and manpower realities of independent development are in part responsible for these actionless adventure games. They're cheaper to make than a game with tons of 3D characters fighting in complex worlds, for instance, and the lack of the corporate structure necessary to make large-scale productions generally allows more room for the forms of personal expression that colour these stories. Steve Gaynor notes that some publishers have already noticed potential in the style, though, pointing to games like *Alien: Isolation*. Made by Creative Assembly, it's a game that Gaynor says is "really focused on being at least combat light, you know, if not totally combat-free."

But Wreden doesn't believe the genre's distinctive flavour will be retained in the hands of the bigger publishers. "By the time you get up to that level, [the genre's] so commonplace that it's not even notable, right? You're not going to get Ubisoft putting $100 million into a combat-less game until the culture and market is already so saturated with actionless games that it's a safe bet. By the time this is happening a lot, then who cares? We've got a lot of games, so it's not like we need Ubisoft making another."

Jonathan Blow built his reputation on a game that warped the fundamentals of *Super Mario Bros*, but it still had you stomping on enemies.His next game, *The Witness* (pictured), trades even the soft action of *Braid* for the peaceable exploration of peers like *Gone Home* as well as the pastoral psychedelia of *Ether One*



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» QUICK TIPS

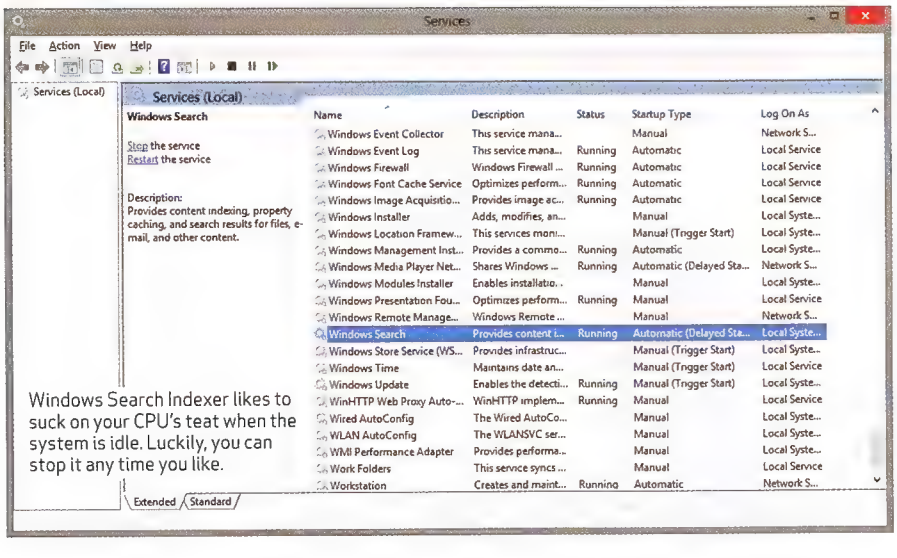
Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

WINDOWS
KERNEL CHAOS

I've been having problems with my system randomly running incredibly slow and freezing for a minute or two before speeding back up. I'm generally not doing anything system intensive, just web browsing or listening to music. I've pulled up Task Manager and it will show the process labelled as "System" at 100% disk utilization. I've identified it is "ntoskrnl.exe" causing this problem. Searching the web I've found this is a common problem but there are no solutions. Any ideas? I'm running Windows 8.1 Pro 64-bit with all the current updates, Intel Core 2 Duo Quad-Core processor, 4GB DDR3 RAM, and an MSI G41M-P34 motherboard.
— Kyle

This is a tricky problem, and based on our research can be caused by a number of issues. First, update all of your drivers. And we mean every driver, including those for a Bluetooth mouse, your Ethernet card, headphones, motherboard chipset, and more. You can do it manually, but we recommend using SlimDrivers (while installing the latter, make sure you uncheck any boxes offering additional software) as it makes everything incredibly easy. If that doesn't work, it's possible the Windows Search Indexer is to blame. This is a utility that indexes files when the system is idle. Disable this to see if it helps. Type "services" from the Windows 8 Start screen, or in the Run dialog type "services.msc." Scroll down to Windows Search, right-click, and select Properties. Then set it to Stopped. You can also set it to Manual, so you can stop and start it at your command.
APC team



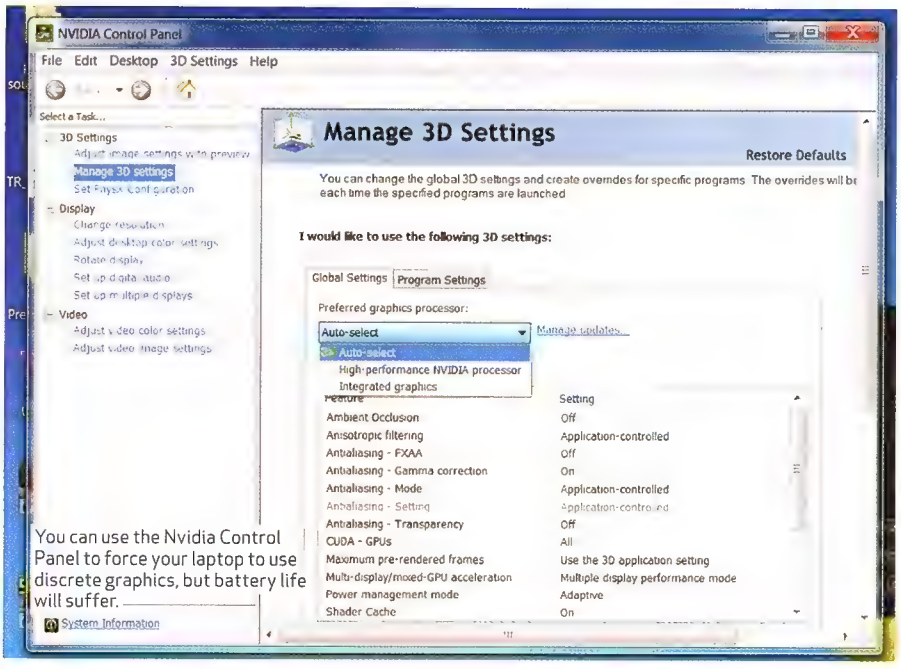
Windows Search Indexer likes to suck on your CPU's teat when the system is idle. Luckily, you can stop it any time you like.

OFFICE
MICROSOFT SUPPORT WOES

I added an SSD to my computer and reinstalled my OS and applications, including MS Office 2010. I'm using a Samsung 840 EVO 120GB SSD, Windows 7 Home Premium, and a 1TB hard drive for programs. My CPU is an Intel Core i5-4670 with an ASUS Z87-Pro mobo. The problem is Microsoft Office Pro didn't activate because the software is for three PCs, and Microsoft thinks it's on more than three because I've had to reactivate it several times. I called Microsoft support, allowed them to take remote control, and they activated it. However, recently, every time I turn on my computer it detects new security updates for Office, which download but will not install. I tried to uninstall (to reinstall) and repair Office through the Control Panel but I got an error. I called Microsoft support and was told the warranty is only for three months and that I need to pay $100 for a one-year warranty. I'm outraged that Microsoft support somehow "locked" their software and then want to charge me to do something about it. Please advise me what alternatives I have.
— John

Activation problems with Microsoft products can often require a call to a dedicated activation phone number.

We think there are two things being mixed up here. The first is direct support for Office 2010. That is likely over, depending on when you bought your Office 2010. The warranty is usually tied to the first date it is activated. The key word here is activation. Microsoft will not give you free warranty support, but it should activate the product on the machine it's on without having the warranty support. It always has in the past. Your real problem is not being able to uninstall and reinstall it. Frankly, on a clean install of Windows 7 with a clean install of Office 2010, there should be no issues. You may want to do a clean install with only the SSD in place. Install the drivers for your hardware, update Windows, and then install Office 2010. Also download the two Service Packs for Office 2010 and install those. Once those are installed, fire up Word. If it asks to activate, attempt it across the internet. If that doesn't work, perform a phone activation. You'll need to be in front of your PC to read off enough digits to think you've just authenticated the launch codes for a ballistic missile.


NVIDIA Control Panel
File Edit Desktop 3D Settings Help
Select a Task...
3D Settings
Manage 3D settings
Display
Video
Manage 3D Settings
Restore Defaults
You can change the global 3D settings and create overrides for specific programs. The overrides will be used each time the specified programs are launched
I would like to use the following 3D settings:
Global Settings
Program Settings
Preferred graphics processor:
Auto-select
High-performance NVIDIA processor
Integrated graphics
Setting
Ambient Occlusion Off
Anisotropic filtering Application-controlled
Antialiasing - FXAA Off
Antialiasing - Gamma correction On
Antialiasing - Mode Application-controlled
Antialiasing - Transparency Off
CUDA - GPUs All
Maximum pre-rendered frames Use the 3D application setting
Multi-display/mixed-GPU acceleration Multiple display performance mode
Power management mode Adaptive
Shader Cache On
System Information
You can use the Nvidia Control Panel to force your laptop to use discrete graphics, but battery life will suffer.

"Microsoft will not give you free warranty support, but it should activate the product on the machine it's on without having the warranty support. It always has in the past."

If that fails, the phone activation will usually let you speak to a live person. Explain that your drive failed and you had to reinstall and they should give you the code to activate it. Once it's activated, start Word. It will ask you if you want Windows Update to check for updates for it. Say yes. Run Windows Update no less than three times, with reboots in between, until all of the updates are installed. If Microsoft gives you a hard time, you should know that Office 2010 retail ties the keys to the device but they're not permanently attached. You can rebuild, swap motherboards, or move the license to your laptop. It should not matter. With Office 2013, Microsoft tried to change that, but facing an intense backlash, the company reversed its policy.
APC team

SOFTWARE
CPU AND GPU TURF WAR

I have a Toshiba Qosmio laptop. It has a GPU built into the CPU and a discreet GPU. With some files, particularly PDFs, it takes a tremendous amount of time to render successive pages. My thought is that it's utilizing the CPU-based GPU. How can I get the laptop to always use the discreet videocard?
— Chris

A more worthwhile endeavor might be to try other PDF readers. Foxit Reader, for example, is both good and free. If that still doesn't do it for you, you can force your notebook to run on its discrete GPU by right-mouse clicking on the desktop. Select Nvidia Control Panel, then Manage 3D Settings, click the drop-down menu under Preferred Graphics Processor, and then select your "high performance Nvidia processor."
APC team

HARDWARE
RODENT RAGE

I'm running Windows 8.1 on my new desktop PC. I connected my Razer Mamba 2012 wireless mouse and from time to time, it freezes. The battery lights on the mouse stay on, but the pointer freezes. When I plug the wired cable into the mouse it works like normal. I'm using the latest mouse firmware and have reapplied it as well. I'm also using the latest Synapse software and have uninstalled and reinstalled it. I've even changed USB ports where the mouse is plugged in. I've contacted Razer and they told me to do the things I already did. Beyond that, they said the mouse is not in warranty any longer and can't help further. Any thoughts?
— Jav

Troubleshooting wireless problems from afar is near impossible, but we can suggest a few steps. First of all, it sounds like you've done all the basic steps we'd recommend for any hardware that is acting up, which includes updating drivers, trying a different port, and making sure the firmware is up to date. You clearly know what you're doing. The next thing is to try and isolate the issue – is the mouse broken or is it your PC? Take the mouse to work or to a friend's house and see if it works in wireless mode there. If so, we know the problem is with how it's communicating with your rig, but that it still works. If it's broken in a second location with a different PC, then you have a lemon, but at least you know what the problem is. Lastly, we'd recommend seeing if the wireless communication is being interferred with where your PC is residing. We

Troubleshooting PC peripherals, like wireless mice, often requires a methodical approach.

All discrete graphics cards from AMD and Nvidia should allow you to hook up multiple monitors, even when using CrossFire or SLI.

"Whether or not you should wait for Broadwell, Skylake, or some other chipset/CPU combo depends on your needs."

know you can't easily move your rig but we'd recommend trying the wireless setup somewhere else in your house just to rule out one final cause of disruption. Since it's out of warranty, there's not much you can do if it's broken (which all signs indicate it is), but at least you can sleep at night knowing what's causing the issue.
APC team

HARDWARE
THE GPU CONUNDRUM

I have a custom made desktop computer that I've been tinkering with for some time. It uses dual GTX 780 GPUs plugged into a 4K Samsung monitor connected via Displayport. My question is whether or not it's possible to have a dual monitor setup with the second monitor running 1,920 x 1,080 connected via HDMI to the onboard Intel HD 4600 graphics chip that came integrated with my Core i7 processor? Currently, Windows 7 Home Edition does not even see the HD 4600 graphics on my PC. I was told this is because when a discrete graphics card is used, it automatically turns off the integrated graphics. If this is true, how do I go about changing that so I can use my discrete GPUs for my 4K monitor and the HD4600 graphics for a second monitor? Do I have to reboot Windows without the GPUs installed to force it to recognise the integrated graphics, and then reboot again with the GPU installed, or will that turn off the HD4600 as well? Also, will the second monitor connected via HD4600 graphics need an HDMI connection or another Displayport connection via the motherboard? Any help is greatly appreciated.
— Jason Mesa

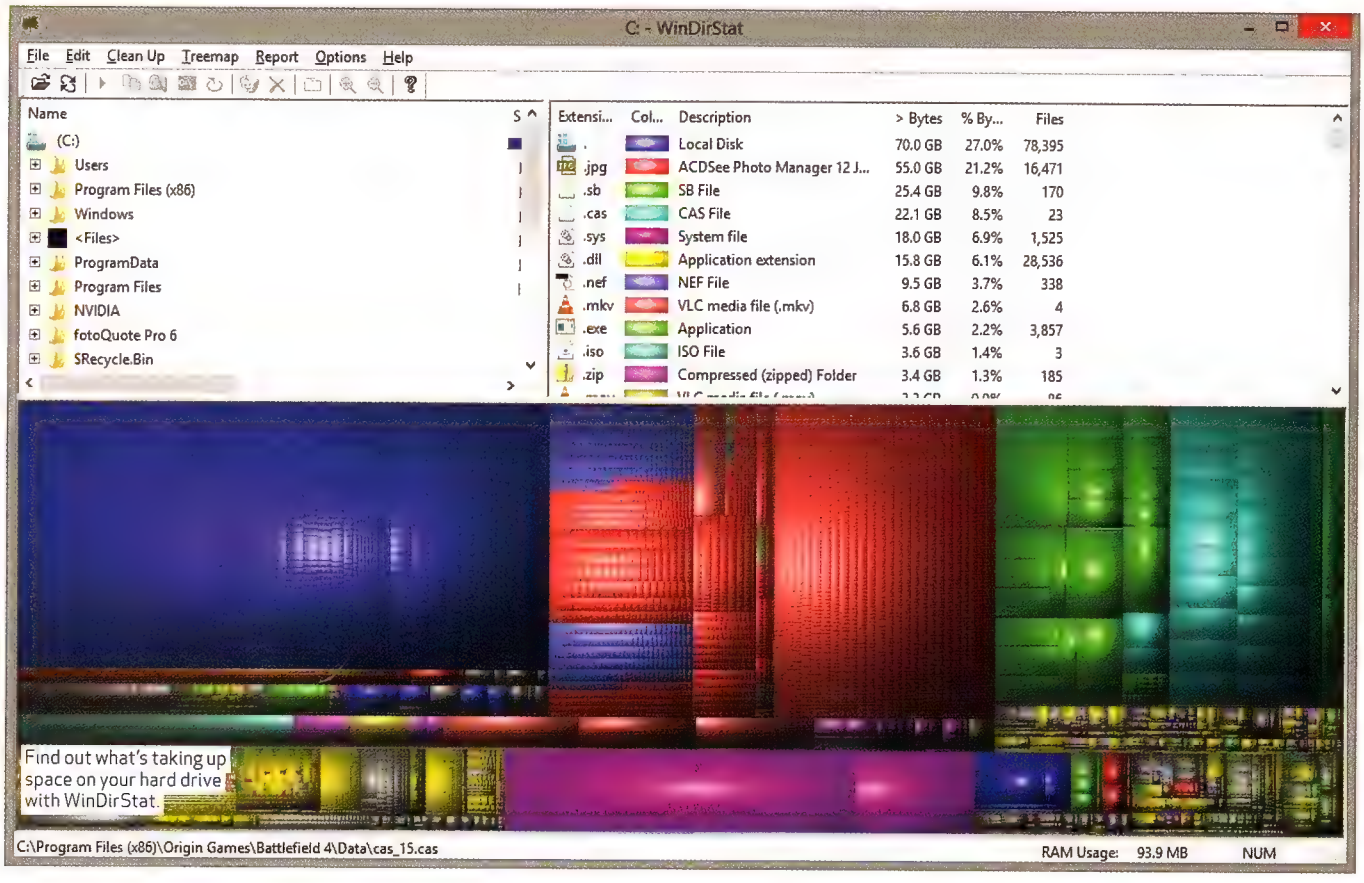
The short answer to your question is that it's not possible with the combo of GTX 780 cards and integrated Intel graphics. You can use one or the other, but not both at the same time, and there's no reason for you to use the integrated graphics at all. Some combinations of AMD hardware (both CPU and GPU) do allow this, but not on the Intel/Nvidia side of things since those camps don't play nice with each other. However, you can run a second display from your GPUs, as rendering a 2D desktop requires very little processing power for today's video cards. To do that you would just need to go ahead and plug both monitors into one of your 780s. Check Nvidia's web site for instructions on how to connect dual monitors for SLI to figure it out.
APC team

HARDWARE
UPGRADE OR WAIT?

My system is comprised of an Intel Core i7-920 at 3.8GHz, ASUS P6T motherboard, 16GB RAM, Crucial m500 480GB SSD, 4TB hard drive, Gigabyte WindForce GTX780, with Windows 7 64-bit Pro. Although I can play games maxed out at 1080p, I'm looking to upgrade the CPU and motherboard soon. Should I wait for next generation or go for Haswell-E now (i7-5820)?
J. Richard Burton

Whether or not you should wait for Broadwell, Skylake, or some other chipset/CPU combo depends on your needs. If you were to spring for a Haswell-based Intel Core i7-4970K on the LGA 1150 platform, that would still be a big upgrade you'd definitely feel, and you could keep using your DDR3 RAM. If you went

Upgraders need to think hard about the X99 chipset's arrival, as it will also require still-expensive DDR4 RAM.


C: - WinDirStat
File Edit Clean Up Treemap Report Options Help
Name
(C:)
Users
Program Files (x86)
Windows
<Files>
ProgramData
Program Files
NVIDIA
fotoQuote Pro 6
SRecycle.Bin
Extensi... Col... Description > Bytes % By... Files
Local Disk 70.0 GB 27.0% 78,395
.jpg ACDSee Photo Manager 12 J... 55.0 GB 21.2% 16,471
.sb SB File 25.4 GB 9.8% 170
.cas CAS File 22.1 GB 8.5% 23
.sys System file 18.0 GB 6.9% 1,525
.dll Application extension 15.8 GB 6.1% 28,536
.nef NEF File 9.5 GB 3.7% 338
.mkv VLC media file (.mkv) 6.8 GB 2.6% 4
.exe Application 5.6 GB 2.2% 3,857
.iso ISO File 3.6 GB 1.4% 3
.zip Compressed (zipped) Folder 3.4 GB 1.3% 185
Find out what's taking up space on your hard drive with WinDirStat.
C:\Program Files (x86)\Origin Games\Battlefield 4\Data\cas_15.cas
RAM Usage: 93.9 MB
NUM

with a Haswell-E upgrade via a Core i7-5820K, you'd have to buy expensive DDR4 memory, plus a more expensive LGA 2011-3 mobo. But that said, if you can see a need for 12 CPU threads, the Core i7-5820K CPU is the way to go. Its X99 motherboard chipset should also be compatible with Broadwell-E CPUs when those come out in Q3 of 2015.
APC team

WINDOWS
IS IT REALLY FULL?

I recently moved from overseas and brought my PC with me. I made sure to disconnect my hard drive cables to make sure they were not damaged in the move. When I reconnected them, the primary hard drive was fine. However, the backup hard drive is saying that it's low on space whenever I try to run my backup program. The weird thing is they are both the same size hard drives. I'm making sure to only keep the latest copy of the backup data, so what could be keeping the computer from properly backing up?
Alexander

We have no idea what backup program you're running Alexander, or why one of your drives would suddenly be full, but step one for diagnosing any problem involving a surprisingly full hard drive is to investigate what is taking up all that space. We prefer the freeware program WinDirStat (**windirstat.info**) as it's free, and we're cheap, plus it's also easy to use and shows you exactly what is hogging all them bits, both in graphical and numeric displays. Download that program and point it to your "backup" drive in order to find out what's taking up all that space. Second, be sure to closely examine your backup program as it sounds like it's just saving image files to the drive and not deleting the older one, or just updating the image file with what's changed since the last time your ran it. For what it's worth, we still use the popular freeware backup and syncing tool named SyncBack (**tinyurl.com/apc413-sync**). It's free, and can sync drives or perform backups, so if you're in need of a new program to manage your data we highly recommend it.
APC team

HARDWARE
INTERROGATING MY RAM

I bought a PC through an ad in my local paper, and I'm benchmarking it to see how much of a bargain or lemon it was. I can right-click 'This PC' in Explorer and view properties to see how much RAM I have, but it doesn't tell me what kind or how fast it runs. Is there another Windows tool that will tell me more, or do I need to Google the serial numbers on the chips themselves?
Brian Heaton

Googling the RAM serial numbers seems like the long way around. A better option would be to use the tool at **www.crucial.com** to see what RAM the motherboard supports. Even if it's a home-built golem PC and you can't find a make or model identifier on the motherboard itself, the Crucial tool will scan your system for you. But you don't even need to do that. Windows uses the Windows Management Instrumentation thingy ('service', I guess you'd call it) to provide information about the hardware and drivers to software applications that ask nicely. This is what the online tool and other utilities like CPU-Z do, but you can do it for yourself with the WMIC command. Enter `wmic` at the command prompt and hit Enter. Type `MemoryChip get BankLabel, Capacity, MemoryType, TypeDetail, Speed` and hit Enter again. The MemoryType field will be 20 for DDR, and 21 for DDR-2. DDR-3 memory should return a MemoryType of 22 or higher, but I've noticed that it often returns 0. This is technically 'Unknown' but you can nearly always take it as meaning DDR-3. You can read a full list of the possible values at **tinyurl.com/krb24wm**.
Luis Villazon

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disc contents

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ISSUE 413 MARCH 2015

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Make on-disc multimedia presentations with Ashampoo Burning Studio 2015

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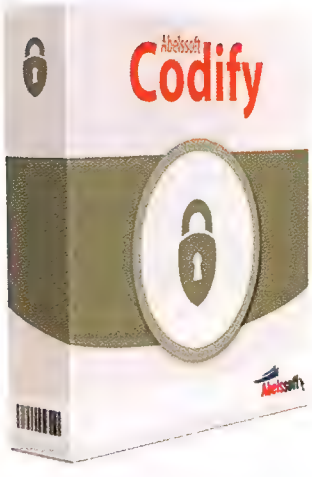
Discover the easy way to achieve professional results with an incredible intuitive, compact, yet immensely powerful Ashampoo Burning application. Create video DVDs with fully-animated menus, music CDs with individually designed covers, password-protected data backups and so much more with just a few mouse clicks. Turn your photos into slideshows, add music and comments or save your CD collection to your hard disk.



LET YOUR PC MICROMANAGE FILE BACKUP & SYNC

Make backup a breeze with 1-abc.net Synchronizer 7

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1-abc.net Synchronizer will compare folders and detect new and modified files, ensuring that the latest versions are in two separate, nominated folders. You can start a synchronisation manually, or configure the program in a way that it does this job for you scheduled and automatically. Perfect for those who make regular backups of both folders and drives.

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PLUS! ALL THE WAY DOWN: FULL GAME & 5 BACKUP AND RECOVERY TOOLS

SYSTEM REQUIREMENTS

- A DVD-ROM reader or burner.
- The *APC* disc is designed for use with up-to-date browsers (for example, Internet Explorer, Chrome, Firefox).
- The interface included on the *APC* disc requires a JavaScript-enabled browser.
- An internet connection may be required for online registration of software before use.
- The software packages on the *APC* disc have different system requirements. Software is included on the disc for Windows Vista, 7 and 8.

BEFORE INSTALLING

- Check the disc using a virus scanner complete with the latest antivirus data updates. The disc was checked before burning, but new viruses are being discovered all the time.
- Back up any important system and data files. It is not recommended that the software contained on these discs be installed on production machines.
- If you have any questions regarding the use of the *APC* disc, click the 'Help' button at the top of the screen.

USING THE DISC

- Insert the disc into a CD/DVD-ROM reader or burner and your web browser should automatically load the interface. If not, launch your web browser and load the default.html file from the root directory of the disc.

HELP

- If you have any problems with the *APC* disc, please visit **www.apcmag.com/disc.htm**.
- *APC* provides no technical support for this disc or any software provided on it.

NO DISC?

Please note the free cover disc is not included with digital editions or bundled promotional copies of *APC*.

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Encrypt important data in Windows

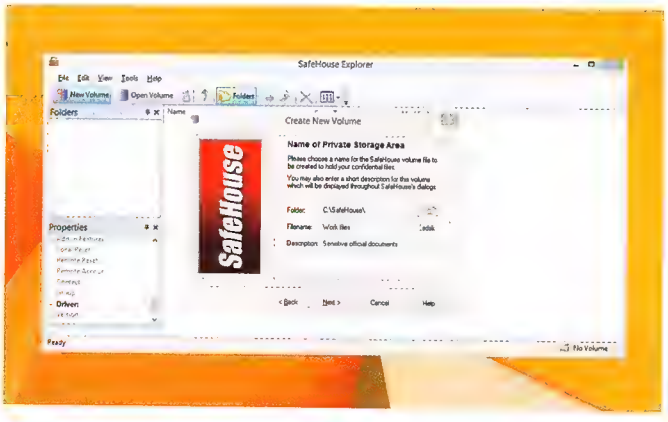
Mayank Sharma helps you make password-protected data silos on your hard disk and USB drives to keep your important and sensitive files safe from prying eyes.

SafeHouse Explorer is a freely available software with which you can create encrypted storage areas known as volumes. Any files you place inside these encrypted storage vaults are automatically encrypted using the industry standard 256-bit Twofish encryption scheme. You can create as many volumes as you need.

When you open the encrypted volumes in SafeHouse Explorer, they appear as drives in Windows Explorer. You can then simply drag and drop any files inside these virtual drives or even save files directly inside them since they'll appear as regular drives within any Windows application. Also, since the entire program resides in a single .exe file, it can be moved into a portable drive along with the encrypted data. This allows you to run the program directly from the USB disk and decrypt your data on any Windows computer.

step-by-step

Password protect your files.

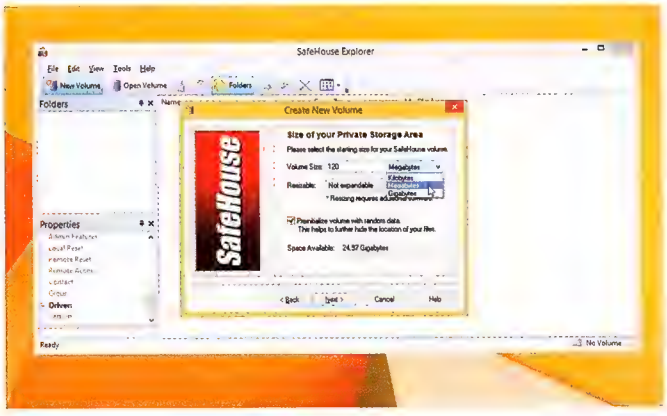


1 DOWNLOAD AND INSTALL

Get SafeHouse Explorer from **www.safehousesoftware.com/SafeHouseExplorer.aspx** for free. Double-click on the downloaded .exe file to launch the setup wizard. During set-up, the app will install a special Windows to improve performance. When you launch the app for the first time, it'll guide you through a welcome wizard to help you create your first vault.

2 DEFINE A VOLUME

To create an encrypted volume, click on the 'New Volume' button. This will launch a wizard that'll guide you through creating the volume. In the first step, you'll be asked to select the location of the encrypted volume. Use the file explorer button to navigate to the drive and folder you wish to store the volume under. Give a name and a brief description of the storage area.

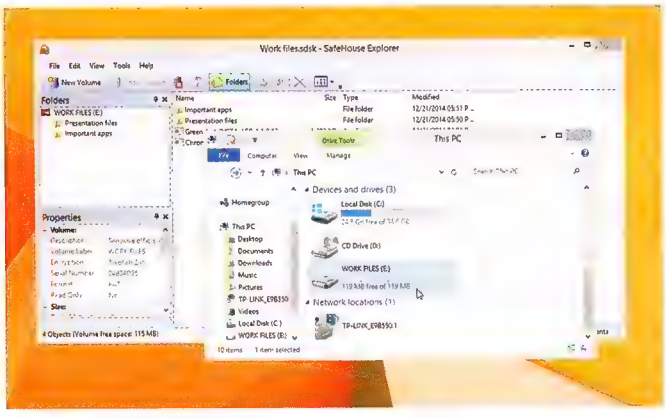


3 SPECIFY ITS SIZE

Next you need to specify the size of this private storage area. Enter the size of your volume in the 'Volume Size' field. This size can be either in megabytes, kilobytes, or even gigabytes, but make sure it doesn't exceed the size mentioned in the Space Available field at the bottom. Go with the default settings for the other options.

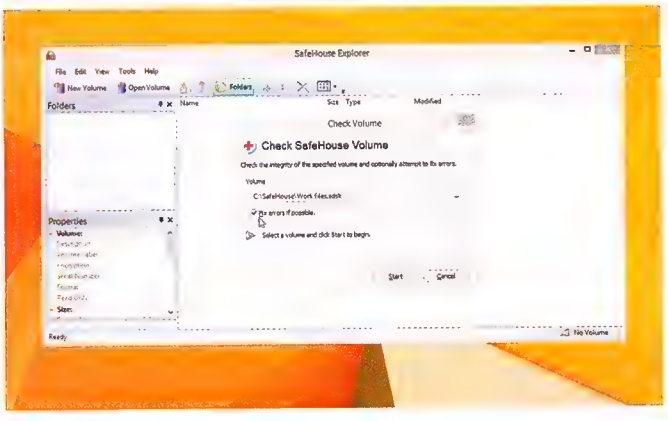
4 CREATE VOLUME

Round up the procedure by entering a password. The program will ask you for this password every time you need to unlock the volume to access your files. If you forget this password, there's no way you can recover it and the encrypted files will be lost forever. When you are done, review the settings and click on the 'Create Volume' button.



5 INTERACT WITH THE VOLUME

Once the volume has been created you can use the 'Open Volume' button in the main interface to open it. The program will prompt you for the password you specified earlier to open the volume. Once open, you can drag and drop files into it and it also appears in Windows Explorer. Click on the 'Close Volume' button to lock the storage area.

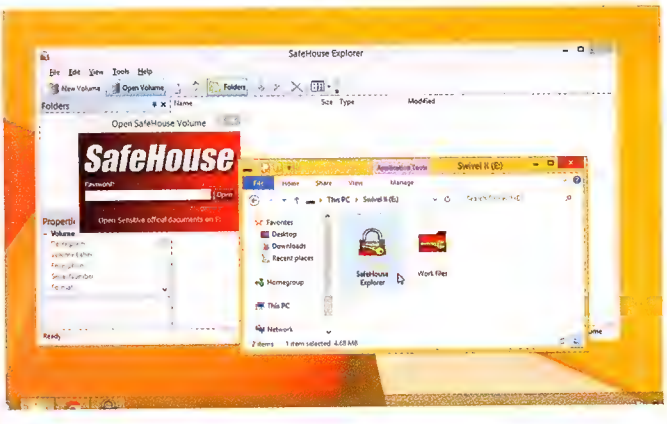


6 VOLUME MAINTENANCE

An important aspect of keeping data inside encrypted volumes is to regularly check their integrity. SafeHouse Explorer includes a tool to do just that. Make sure the volume you wish to check isn't open. Then go to 'Tools > Check Volume' to launch the integrity check wizard and point to the volume's .sdsk file. You can also select 'Fix error if possible' to repair any damages.

7 ENCRYPTED USB DRIVES

SafeHouse Explorer lets you take the encrypted volumes on removable USB drives along with the program itself. Plug in a USB drive and head to 'Tools > Copy Files to Memory Stick'. In the window that opens, select 'Copy Volume' and point to the volume you wish to copy to the USB drive. Make sure 'Copy Program File' is selected and the program is pointing to the correct USB drive.



8 READ ENCRYPTED FILES

Once the program has copied your encrypted volume to the USB disk, it'll include the volume as well as the program's .exe file. Plug in the drive on any other Windows PC and double-click on the .exe file. Follow Step 5 to open the encrypted volume on the USB disk. You can now move your files inside an encrypted volume, carry them and access them on any Windows PC. ■

Recover lost Linux files

Sean Conway regales us with a story of Linux distro woe and how to use PhotoRec to recover files when you've been a bit too blasé during an install...

When a system administrative error re-formats a hard drive containing professional and personal data that has no backup, time gives way to despair. A speaker at a recent professional development course suggested you have a better chance of a person listening if you take your lesson and wrap it in a story. So if you don't make regular backups of your data, this story on recovering data may be something you'll need.

Not satisfied with Ubuntu and Gnome 3, a magazine article gave this writer reasons to change. A bootable disc provided a convenient software source for a Linux Mint test drive. Replacing the OS hard drive with a spare hard drive made it easy to start the install from the self-booting disc. With admin impatience born of numerous system installs, the hunts and pecks were completed to fire up the installation. As the installation's progress streamed a green line across the screen, we reflected on how the Mint installation questions compared to other Linux distro installs. Why, we mused, was the Mint installation occurring on a hard drive with an 80GB capacity when the drive to be used was only 40GB? Then the brain synapses fired producing a response just at the moment when the screen indicated it was 'formatting'... Ah...NOOO! "Houston we have a problem," to steal a famous line from Swigert on Apollo 13 when he reported that fault in the electrical system of one of the Service Modules. The progress bar displayed 16% by the time our conscious mind understood what had happened, and eventually the author's index finger lost colour from holding down the off button. The distro's installation progress injection bar pulsed another five seconds before the whirring fans went silent.

The drive formatting had started on an 80GB hard drive that was a data drive: scribblings, thoughts, ideas, published articles and unpublished writings were on that sole repository – three years of content had been erased. Oh dear.

THE NATURE OF DATA

Having technical knowledge of what happens during a format did little to discourage me from whispering to the computer deities and Saint Stallman, "Maybe it's OK, I turned the power off before it finished." However, the file manager application coldly displayed a pristine directory structure of a Linux OS. The Mint Linux installer had completed the task of formatting the hard drive and gone on to create the file system before it was interrupted. But was the data still on the hard drive or had it all gone?

Data written to a hard drive has some similarities to written words on a page. In a book, words are chained together to form sentences and paragraphs. On a hard drive, blocks of data are chained together to form files. The index in a book is how the reader locates the chapter in the book. In Linux, the Virtual File System (VFS) contains the directories, names and block structure for the files. If the index is removed from a book, the reader knows the words are still on the pages of the book. When a system is formatted the file system is laid down but the data blocks on the drive that aren't used in building the file system are untouched.

In order to restore files, the recovery process must find all the data blocks associated with a file and chain them together. This process constructs the file without the assistance of a directory. When working on restoring a hard drive it's advisable to minimize the amount of hard drive use. Powering up and manipulating a hard drive that contains the last known link to the lost

```
File  Edit  View  Terminal  Tabs  Help
PhotoRec 6.14, Data Recovery Utility, July 2013
Christophe GRENIER <grenier@cgsecurity.org>
http://www.cgsecurity.org

Disk /mnt/dest/sconway/temp/recovery_hope.dd - 15 GB / 13 GiB (RO)
     Partition                  Start        End    Size in sectors
   P ext3                     0   0  1  1823 174 15   29297472 [/home]


Pass 1 - Reading sector    8549328/29297472, 7353 files found
Elapsed time 0h00m28s - Estimated time to completion 0h01m07
txt: 7297 recovered
mp3: 17 recovered
zip: 14 recovered
elf: 11 recovered
gif: 4 recovered
swf: 4 recovered
gz: 2 recovered
jpg: 1 recovered
rpm: 1 recovered
tar: 1 recovered
others: 1 recovered
  Stop
```

While PhotoRec is chewing on the data, a status of time to completion as well as file types recovered is displayed.

Investigating

As the police pound on the door attempting to enter the gang's hideout, Books Malone nicknamed The Accountant, is on his laptop issuing commands to delete entire directories of files. "You will never take my data alive, copper!" A nefarious persons undoing can be in thinking he/she has removed files from a hard drive by simply using the Delete key, but they may not be aware that the file data still exists and is recoverable. A process that minimizes working with the evidence hard drive is important. For a successful forensic investigation preserving the integrity of the data, ensuring no changes have occurred as part of the recovery, is critical to an investigation.

data introduces the risk of doing additional damage.

An industry best practice is to make a copy of the troubling hard drive and use the copy for examination. Instead of copying the damaged hard drive to another hard drive, you can elect to make a file of the damaged drive. Hard drive data in one file creates a flexible container to manage and manipulate the data. Executing the following command from a terminal, will copy the contents of a hard drive to a file:

```
dcfldd if=/dev/<identifier>
of=/<path>/recovery_hope.dd
conv=noerror,sync hashwindow=0
hashlog=recovery_hope.txt
```

Replace <identifier> with the drive designation of your test station. Replace <path> with the path name you are using to hold the file.

"Knowledge of what happens during a format did little to discourage me from whispering to the computer deities."

The dd command line program has a complex command structure. The dcfldd command is an enhanced version of the old dd program, maintained by Nicholas Harbour, and can be downloaded from **dcfldd.sourceforge.net**. if= is the input file (ie, the data hard drive file) attribute and of= is the output file (i.e. data file) attribute. It's important to have sufficient storage capacity where the output file is written. The output file of the command will be the same size as the capacity of the hard drive.

The time it takes for the command to complete depends on the drive size. It can be frustrating to wait hours and then discover a failure because the output device didn't have capacity to handle the file being produced. With the source, destination and other command attributes defined, the command can be issued. After this process is complete, the troubling data hard drive can be removed and physically secured. From this point forward only the data file representing the hard drive contents is used in the process.

RECOVERY BEGINS

Using the data drive file, we're going to execute the photorec command to start the file recovery process. The program is command line driven and part of the TestDisk utility. If it's not already installed on your distro use the usual `sudo apt-get install testdisk` for Debian/Ubuntu or `yum install testdisk` for Fedora/CentOS. PhotoRec uses a number of menu screens to establish the parameters it requires to start the recovery. The program will produce a series of directories containing recovered files. These files are identified using a number scheme generated with a file extension. The official wiki (**www.cgsecurity.org/wiki**) has a list of files that PhotoRec is capable of recovering.

```
photorec <path to hard drive
dd file>
```

The PhotoRec data recovery software is designed to examine the contents of a drive. The program is examining the block metadata, to determine if the blocks are chainable to form a file, and it doesn't need the VFS. The program will work even if the file system has been severely damaged or in this case reformatted. The location selected to store the recovered files should have the same space capacity as the drive you are recovering.

Since normal file deletion only removes the pointer in the VFS and not the actual data blocks, PhotoRec may recover files long forgotten. The program is distributed by the developers at CG Security (**www.cgsecurity.org**) under the GNU General Public Licence. The program provides a progress field, and chewed on our 80GB file for close to three hours before it completed. In the process, it produced about 180 separate directories with well over 10K files.

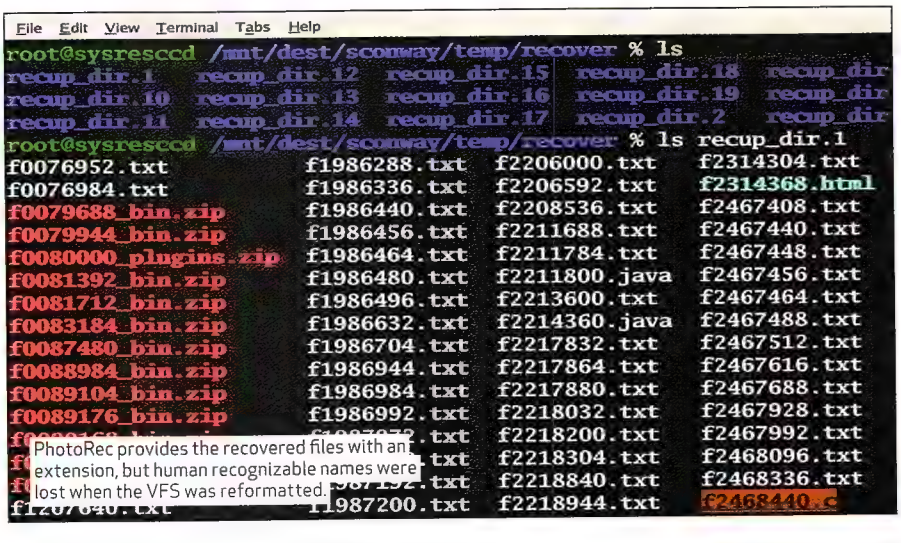
However, in our case the joy of recovering the lost data was short lived, as over 10k files with number sequences followed by file extension for file names, is more metadata than this human can handle. We were actually keen to find one file to meet a typically short publishing deadline. From the root of the recovered data directories you can execute the following command. `find -name \*.odt -exec cp {} <path to store openoffice files> \;`

The output delivered 51 files with an .odt extension, and examining the individual files we discovered the required publisher's manuscript. The recovery process didn't restore the drive to its original condition, however. Some files were lost because the data had already been overwritten.

Before we started the recovery process, we spoke to a professional data recovery service. Unfortunately, they couldn't guarantee the recovery of the files we needed or that they could only provide anymore than a percentage of recovered files after analysing the drive. I now have a cron'd rsync script and a new one terabyte of USB drive storage as a constant reminder of the reason for regular backups. Lesson learned.

Defining metadata

Metadata is a term used to describe data about the data. For example, the picture on a puzzle box is metadata for the user about the puzzle. The user refers to the box picture to identify specific areas of a puzzle and then proceeds to look for the colour or picture components in the puzzle pieces. The file recovery process relies on metadata for file recovery. Information is written to the hard drive in data blocks. Each data block contains metadata that identifies the block before and after it, in addition it may contain the beginning and end data scheme for the whole chain. Each puzzle piece has shape metadata to help the user locate a corresponding piece that will fit the shape, colour and picture.


File Edit View Terminal Tabs Help
root@sysresccd /mnt/dest/sconway/temp/recover % ls
recup_dir.1 recup_dir.12 recup_dir.15 recup_dir.18 recup_dir
recup_dir.10 recup_dir.13 recup_dir.16 recup_dir.19 recup_dir
recup_dir.11 recup_dir.14 recup_dir.17 recup_dir.2 recup_dir
root@sysresccd /mnt/dest/sconway/temp/recover % ls recup_dir.1
f0076952.txt f1986288.txt f2206000.txt f2314304.txt
f0076984.txt f1986336.txt f2206592.txt f2314368.html
f0079688_bin.zip f1986440.txt f2208536.txt f2467408.txt
f0079944_bin.zip f1986456.txt f2211688.txt f2467440.txt
f0080000_plugins.zip f1986464.txt f2211784.txt f2467448.txt
f0081392_bin.zip f1986480.txt f2211800.java f2467456.txt
f0081712_bin.zip f1986496.txt f2213600.txt f2467464.txt
f0083184_bin.zip f1986632.txt f2214360.java f2467488.txt
f0087480_bin.zip f1986704.txt f2217832.txt f2467512.txt
f0088984_bin.zip f1986944.txt f2217864.txt f2467616.txt
f0089104_bin.zip f1986984.txt f2217880.txt f2467688.txt
f0089176_bin.zip f1986992.txt f2218032.txt f2467928.txt
f2218200.txt f2467992.txt
f2218304.txt f2468096.txt
f2218840.txt f2468336.txt
f1987200.txt f2218944.txt f2468440.c
PhotoRec provides the recovered files with an extension, but human recognizable names were lost when the VFS was reformatted.

Reset your Mac's password

If you forget your password, all is not lost — Matthew JC. Powell knows a trick you can try.

Most people will tell you that when you're setting up a new Mac – even if you're the only person who will ever use it – you ought to have a password. And most people will tell you that a password should be difficult to guess – not something simple like your birthday or your cat's name, or even a word you'd find in a dictionary. Unfortunately, making passwords difficult to guess also makes them difficult to remember.

And there's not much more frustrating than sitting down to log in to your Mac and finding that your mind is a blank and your password nowhere to be found. Even the password hint that shows up after three wrong guesses might not be terribly helpful – maybe it seemed like a good hint at the time.

But fear not, for Apple has provided a number of ways for you to reset a lost password. Obviously some of these tricks can also be used to reset a password on a machine that is not yours, so please use them wisely and honourably.

THE FIRST WAY: RESET PASSWORD UTILITY

We've covered the Reset Password Utility before, in the context of preparing a Mac for resale. You may recall that it's not the most straightforward thing to get to, largely because of the power it possesses.

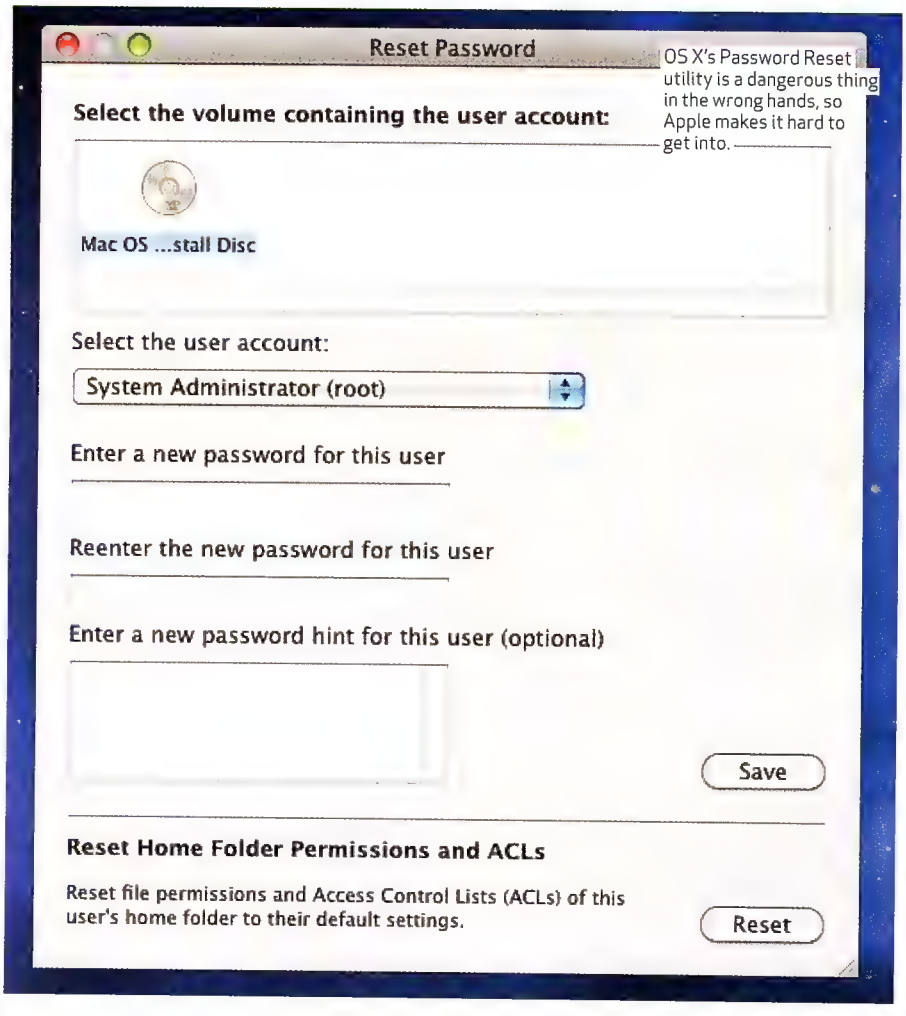
To get to it, restart your Mac and hold down 'Command-R' to go into Recovery Mode. You could also restart your Mac and hold down the Option key, then select the Recovery volume when asked to select a startup disk – but Command-R saves a step.

On the Recovery volume, open the Terminal and, at the prompt, type: `resetpassword` then hit return.

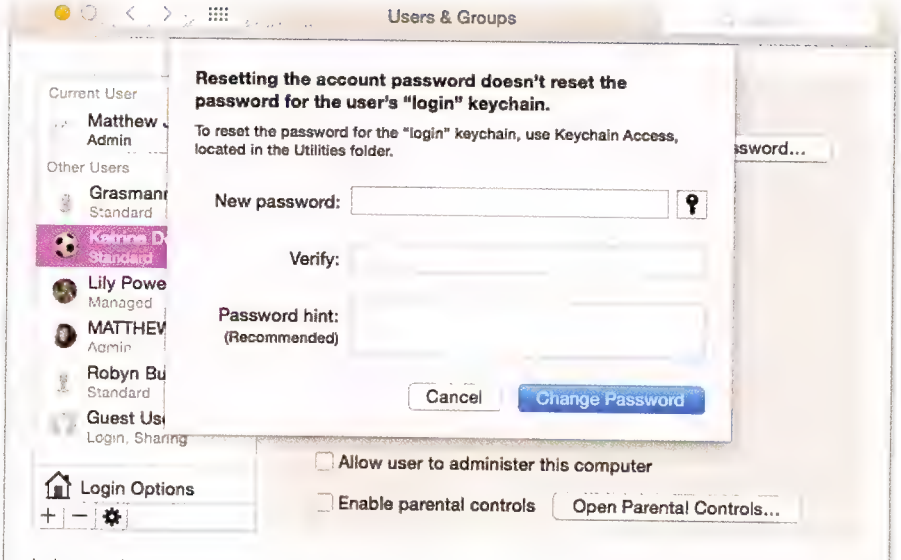
When the utility opens, choose your normal startup volume. Then choose the user account whose password you want to reset (namely yours) from the drop-down menu. Enter a new password (twice) and a new password hint (make it helpful this time) and then click on Save.

When you restart again, your password will have been changed.

Note that if you use FileVault, this trick won't work – FileVault-protected volumes appear in the reset Password


Reset Password
Select the volume containing the user account:
Mac OS ...stall Disc
Select the user account:
System Administrator (root)
Enter a new password for this user
Reenter the new password for this user
Enter a new password hint for this user (optional)
Save
Reset Home Folder Permissions and ACLs
Reset file permissions and Access Control Lists (ACLs) of this user's home folder to their default settings.
Reset

OS X's Password Reset utility is a dangerous thing in the wrong hands, so Apple makes it hard to get into.



As long as the user account whose password you've lost isn't the Admin, it's easy enough to log in with the Admin account and change the password for any Standard user.

utility, but they're greyed-out. You can unlock them using Disk Utility on the recovery volume, but you'll need your password – and there's the catch.

THE SECOND WAY: USE AN ADMIN ACCOUNT

This is actually the easiest way to reset a user password on a Mac, but it isn't the first one listed here for the simple reason that most people don't work like this.

For the best possible security on your Mac, the account you use from day to day should not have Admin privileges. That way if any malware happens to infect you (yes, it can happen to Macs) the damage it can do is limited. Ideally, you should have a separate Admin account that you use when installing and updating software, and the rest of the time use a Standard account.

But people rarely work that way.

If, however, you have set your Mac up with an Admin account separate to your normal user account, you're in luck. All you have to do is log in with the Admin account, open System Preferences, click on Users & Accounts, then select the Standard account you want to log into. Click on 'Reset Password' and away you go.

Wasn't that simple? Next time you set up a new Mac you might keep it in mind.

THE THIRD WAY: ROOT MODE

This is absolutely a last resort. If you're not confident working with Unix stuff you're best avoiding this since it involves fiddling with essential parts of the system – if something goes wrong the consequences can be very bad indeed.

As you no doubt know, OS X is a version of Unix. The pretty face you see in day-to-day usage that makes it all friendly and Mac-like is just that: a pretty face. Underneath it's as text-based and geeky as any Linux box.

Like all Unixes, OS X has a user account called "root" which is essentially the system itself – there are some things the system needs to run in order to work properly that mere mortals shouldn't be allowed to touch. By default OS X's root account is disabled – it's hidden from the prying eyes and curious fingers of humans. This is for security reasons – if you get root access, you can get up to all sorts of mischief, like for instance changing passwords.

Restart your Mac, this time holding down 'Command-S' (S stands for Single-user). Rather than the usual Mac-looking boot routine, you'll see something terribly scary and text-based. This is OK.

When a command prompt appears, type: `mount _uw /` and press return. This allows you to read and write to the boot volume. Next, type

The unbreakable password

Several of the tricks described here involve using Command-key combinations to boot your Mac in alternative ways. As you've probably guessed, you're not the only person who can do that. An Open Firmware password adds an extra layer of security — before anyone can start your Mac in single-user mode, for example, they would need this password.

To set up an Open Firmware password, start up your Mac from an install disc, or from the Recovery volume as described above. Go to the Utilities menu and select 'Firmware Password Utility'. Then click 'Turn On Firmware Password'.

Firmware Password Utility
The firmware password protects this computer from being started up from another hard disk, CD, or DVD.
Require password to start this computer from another source
Enter a password of letters and numbers only.
Password:
Verify:
If someone has physical access to your Mac they can get around your passwords. A Firmware Password makes it harder to do so.
Cancel
OK

```
launchctl load /System/
Library/LaunchDaemons/com.
apple.opendirectoryd.plist
```

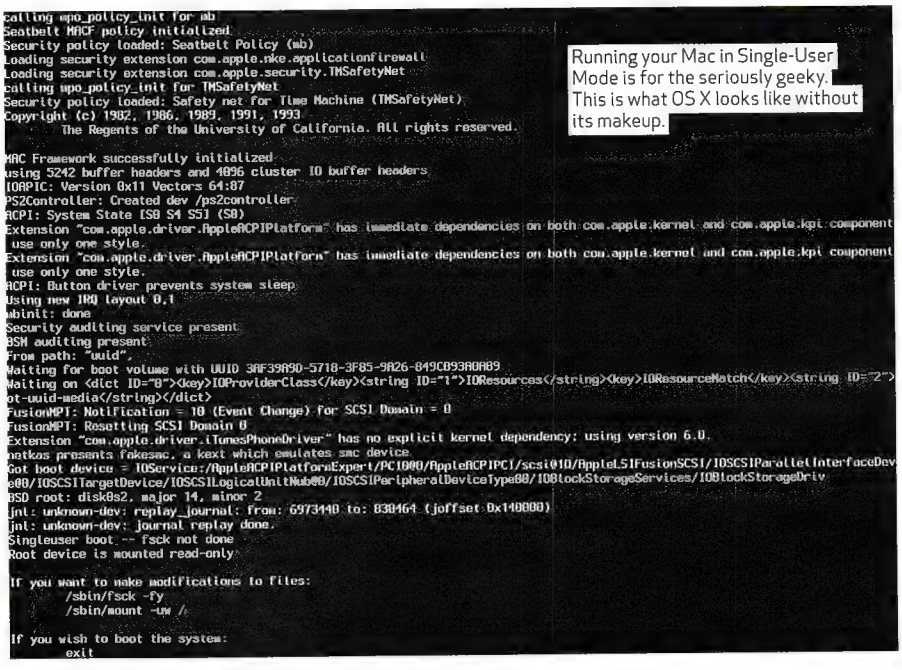
and press return. This launches Open Directory (a ridiculously geeky utility) and opens its preferences file – where user names and passwords are kept.

Finally, type: `passwd username` and press return. Replace 'username' with the short (four-letter) username of the account whose password you want to change – for instance, "mjcp".

You should (if all has gone well) be prompted for a new password. After you type it and press return, you should be prompted to type it again.

Next, type: `reboot` and press return. Your Mac should restart as normal, and your newly defined password should get you in.

Note that even this won't work if you have a Firmware Password on the machine (see above). If reading this tutorial has given you pause to wonder if your Mac is secure enough, maybe you should set one up. ■


calling mpo_policy_init for mb
Seatbelt MACF policy initialized
Security policy loaded: Seatbelt Policy (mb)
Loading security extension com.apple.nke.applicationfirewall
Loading security extension com.apple.security.TMSafetyNet
calling mpo_policy_init for TMSafetyNet
Security policy loaded: Safety net for Time Machine (TMSafetyNet)
Copyright (c) 1982, 1986, 1989, 1991, 1993
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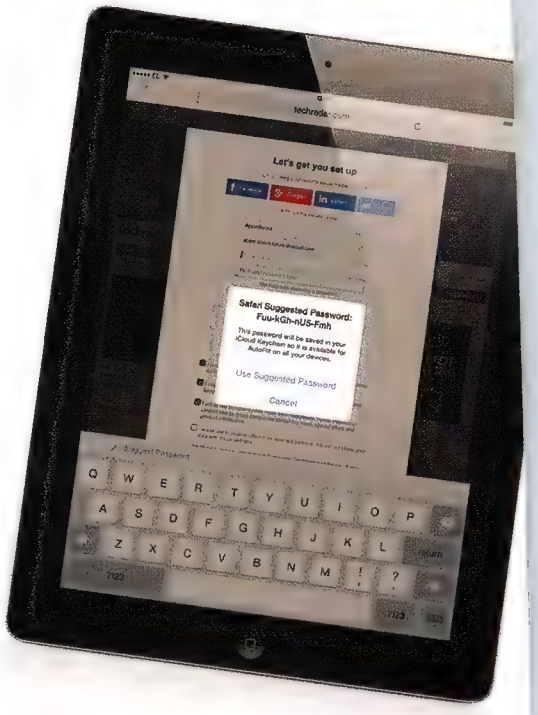
MAC Framework successfully initialized
using 5242 buffer headers and 4096 cluster IO buffer headers
IOAPIC: Version 0x11 Vectors 64:87
PS2Controller: Created dev /ps2controller
ACPI: System State [S0 S4 S5] (S0)
Extension "com.apple.driver.AppleACPIPlatform" has immediate dependencies on both com.apple.kernel and com.apple.kpi component
use only one style.
Extension "com.apple.driver.AppleACPIPlatform" has immediate dependencies on both com.apple.kernel and com.apple.kpi component
use only one style.
ACPI: Button driver prevents system sleep
Using new IRQ layout 0.1
vbinit: done
Security auditing service present
BSM auditing present
From path: "uuid",
Waiting for boot volume with UUID 3AF39A90-5718-3F85-9A26-849CD93A0AB9
Waiting on <dict ID="0"><key>IOProviderClass</key><string ID="1">IOResources</string><key>IOResourceMatch</key><string ID="2">
ot-uuid-media</string></dict>
FusionMPT: Notification = 10 (Event Change) for SCSI Domain = 0
FusionMPT: Resetting SCSI Domain 0
Extension "com.apple.driver.iTunesPhoneDriver" has no explicit kernel dependency; using version 6.0.
natkos presents fakesmc, a kext which emulates smc device
Got boot device = IOService:/AppleACPIPlatformExpert/PC1000/AppleACPIPCI/scsi@10/AppleLSIFusionSCSI/IOSCSIParallelInterfaceDev
e@0/IOSCSITargetDevice/IOSCSILogicalUnitNub@0/IOSCSIPeripheralDeviceType00/IOBlockStorageServices/IOBlockStorageDriv
BSD root: disk0s2, major 14, minor 2
jnl: unknown-dev: replay_journal: from: 6973440 to: 830464 (joffset 0x140000)
jnl: unknown-dev: journal replay done.
Singleuser boot -- fsck not done
Root device is mounted read-only
If you want to make modifications to files:
/sbin/fsck -fy
/sbin/mount -uw /
If you wish to boot the system:
exit
Running your Mac in Single-User Mode is for the seriously geeky. This is what OS X looks like without its makeup.

Set up iCloud Keychain for iOS

How to get started using Apple's online password service.



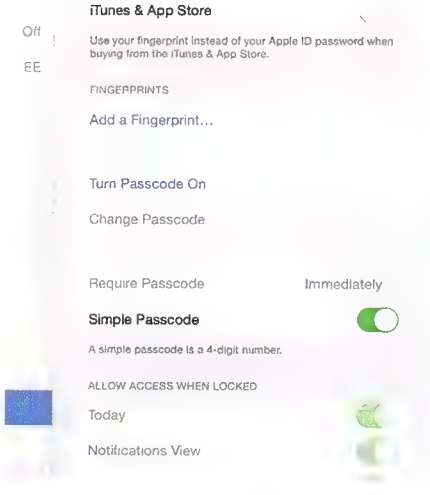
Sometimes it seems like every web site you visit requires you to sign up. This means you have to come up with a strong password – one that's long and complex enough to be hard to crack or guess. Remembering many strong passwords can be tricky.

Tempting though it may be, it's not safe to use the same password for lots of sites. Writing down passwords is also a huge security risk, which is where iCloud Keychain steps in. You can save many different passwords to a keychain that's stored in your iCloud account; the keychain is accessible only on devices on which you sign in with your basic account credentials and then clear a security process to grant access to your keychain's contents on that device.

Keychain remembers all saved details and fills them in for you when required. It keeps login details and passwords in sync across all your authorised devices. So if you sign up to a web site on your Mac, you'll be able to sign in to that site more quickly next time you access it from your iPad or iPhone.

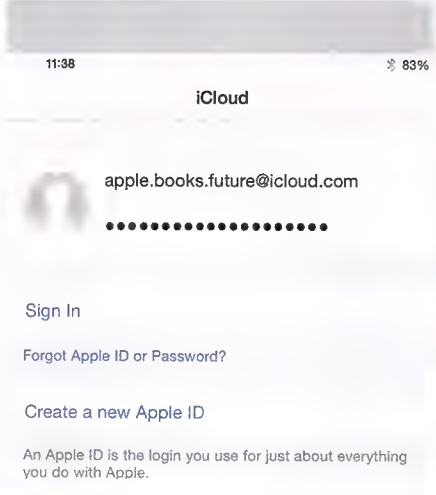
With iCloud Keychain, a single tap of AutoFill enters any login information and password you've saved. So you can more easily use discrete, complex passwords on each site you visit – and iOS can even suggest one for you.

Set up iCloud Keychain on your iPad or iPhone



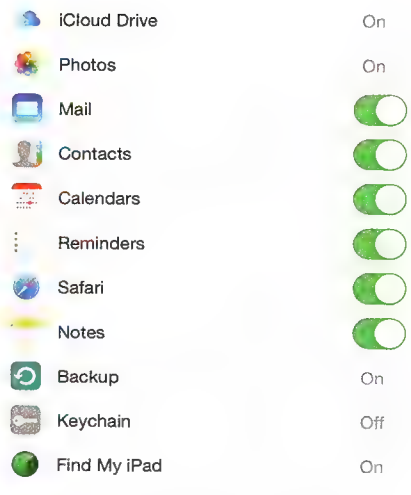
1 SETTING UP A PASSCODE

You should protect your iOS device – and hence your keychain – with a passcode. This code will be needed to access your iPad, and to manage info in iCloud Keychain. Tap 'Settings > Touch ID & Passcode > Turn Passcode On'. Enter a four-digit code, then repeat it to verify your choice. Below that setting, Require Passcode sets a duration before your passcode is required after the iPad locks itself ('Settings > General > Auto-Lock') or you put it to sleep.


11:38
83%
iCloud
apple.books.future@icloud.com
Sign In
Forgot Apple ID or Password?
Create a new Apple ID
An Apple ID is the login you use for just about everything you do with Apple.

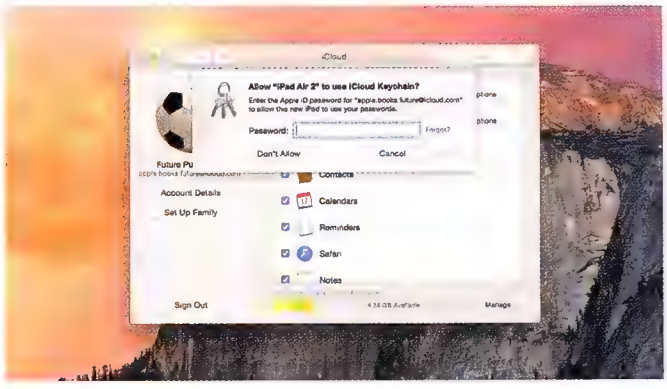
2 SIGNING INTO ICLOUD

iCloud Keychain stores account credentials for web sites and credit card details online, so you'll need to have created an Apple ID and signed in with it under 'Settings > iCloud'. Your device will ask if you want iCloud to use your device location. This isn't needed by Keychain, but it enables the valuable Find My iPad/iPhone service. iCloud should now be running on your device, but keychain requires some extra steps to get working.



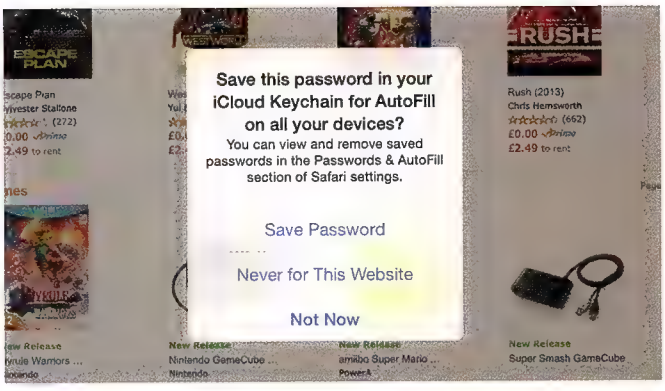
3 SET UP ICLOUD KEYCHAIN

Most iCloud features are switched on by default, but Keychain is one that requires manual activation. Tap 'Settings > iCloud > Keychain' and switch on iCloud Keychain. The device will now request your Apple ID password; enter it and then tap OK. If you've already set up Keychain on another Apple device linked to the same iCloud account, you'll need to approve your iPad or iPhone from that device, or provide the security code you set during that process.



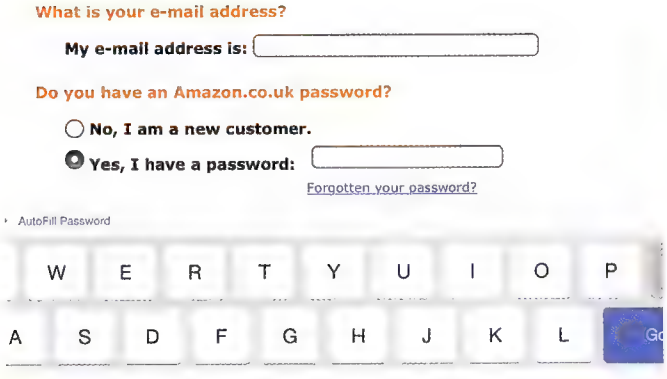
4 APPROVE ACCESS

If you opt to approve access to your keychain using another device, you'll receive a notification on it. On a Mac, click View on the notification to open System Preferences' iCloud pane, then click Details next to the Keychain item. Enter the password for your Apple ID and click Allow. Alternatively, when the notification appears on your other iOS device, enter your password and tap Allow to grant access.


Save this password in your iCloud Keychain for AutoFill on all your devices?
You can view and remove saved passwords in the Passwords & AutoFill section of Safari settings.
Save Password
Never for This Website
Not Now

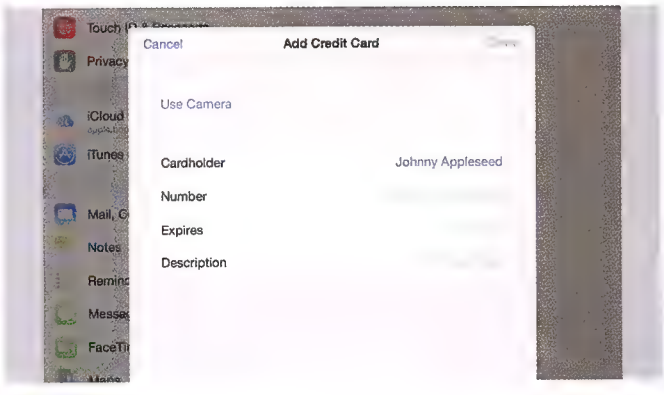
5 SAVE PASSWORD DETAILS

Ensure 'Settings > Passwords & AutoFill > Names and Passwords' is on. In Safari, go to a page that requires a user ID and password. Submit yours. You're given the option to save them, but you can opt not to, either for now (perhaps you're changing them) or never. With iCloud Keychain enabled, the credentials are synced to your authorised devices and you won't have to type them. (When creating an account, 'Suggest password' appears above the keyboard.)


What is your e-mail address?
My e-mail address is:
Do you have an Amazon.co.uk password?
No, I am a new customer.
Yes, I have a password:
Forgotten your password?
AutoFill Password
W E R T Y U I O P
A S D F G H J K L

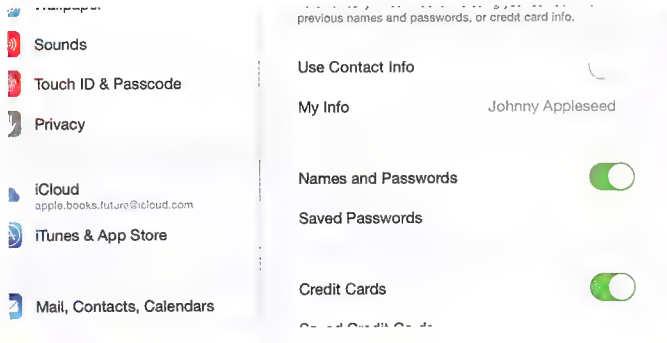
6 AUTOMATIC PASSWORDS

You're able to fill in credentials saved to your keychain using any device you've chosen to authorise to use it. On your iOS devices, when you tap on a form to provide credentials, an AutoFill Password button appears at the top left of the keyboard. Tap that and your user ID and password will be inserted in their respective fields for you, and you only need to tap the form's button to submit the details and sign in.



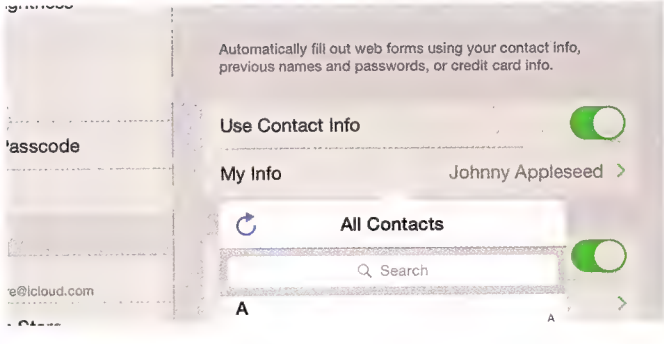
7 CREDIT CARD DETAILS

Bank card details can be stored when 'Settings > Safari > Passwords & AutoFill > Credit Cards' is turned on. When you submit card details to a web site, Safari asks whether to remember them. As a precaution, the security code isn't saved. Cards can also be added in the Passwords & AutoFill settings. Tap 'Saved Credit Cards > Add Credit Card' and type the details, or tap Use Camera to capture them from the front of the card. Enter a description to identify the card.



8 MANAGE PASSWORDS

You can manage passwords in your keychain under 'Settings > Safari > Passwords & Autofill'. Tap Saved Passwords and enter your device's passcode. Tap an item to view the web site address and your username and password. To remove several passwords from the list, tap the Edit button, then the unwanted passcodes, and finally tap Delete to remove them. To remove one quickly, swipe from right to left across it and tap the Delete button that appears.


Automatically fill out web forms using your contact info, previous names and passwords, or credit card info.
Use Contact Info
My Info
Johnny Appleseed
All Contacts
Search
A

9 ADDING INFORMATION

AutoFill can use your details (from the card labelled as 'Me' in the Contacts app) to fill in online forms. In Safari's Passwords & AutoFill settings, if your name is already next to My Info, just switch on the Use Contact Info option. Otherwise, tap My Info, find your name in the list, and then tap it to identify it as you. The Use Contact Info option will be enabled after you do this. In a form, tap a field and then tap AutoFill at the top of the keyboard to insert your details.

Responding to events in PowerPoint

Helen Bradley shows you how to create event handlers to track your activity as you work in PowerPoint.

To program Office applications to respond to events such as double clicks you use what are called event handlers. In PowerPoint event handlers work a little differently to those in, say Excel. This month we'll show you how to configure and program event handlers in PowerPoint.

PowerPoint has a range of event handlers that you can use but, before you can get access to them you'll need to do some coding. To do this, open the presentation you want to use event handlers with and click 'Developer tab > Visual Basic' to open the Visual Basic Editor. If the Developer tab is not visible, choose 'File > Options > Customize Ribbon' and in the right hand panel select the Developer checkbox and click OK.

Inside the Visual Basic Editor choose 'Insert > Class Module' and then type this line of code:

```
Public WithEvents MyPPEvent
As Application
```

This statement sets up a variable that PowerPoint uses to track events and respond to them. Next you create the procedures for those events you want to track so select MyPPEvent from the Object list which is the left hand dropdown box at the top of the Class module window. From the Procedure lists (the rightmost dropdown list) choose the event to track. Start with the ColorSchemeChanged event handler and, between its sub and end sub statements type this statement:

```
MsgBox "Color Scheme
Changed"
```

Choose the SlideShowBegin event handler and type this statement between its sub and end sub statements:

```
MsgBox "Don't forget to
disable your screensaver!"
```

Finally add the WindowBeforeDoubleClick event handler and add this code to it:

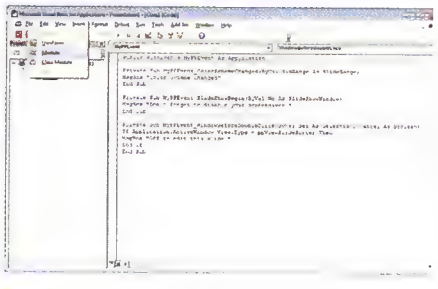
```
If Application.ActiveWindow.
View.Type = ppViewSlideSorter
Then
  MsgBox "Ready to Edit this
Slide?"
  End If
```

The steps below show how to create a module and the required macro that must be run to initialise the event handlers. You will need to run this macro each time you open the presentation file. When saving the file make sure to set the Save As Type to PowerPoint Macro-Enabled Presentation (*.pptm) so the macro code is saved with the file.

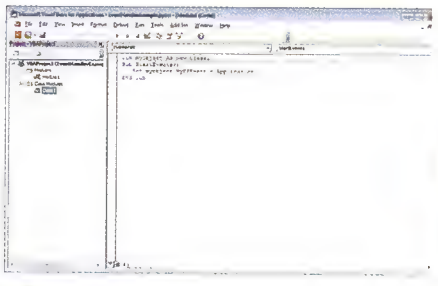
Once you know how to set up event handlers in PowerPoint you'll be able to track events and have PowerPoint respond appropriately to them. ■

> "PowerPoint has a range of event handlers that you can use but, before you can get access to them you'll need to do some coding."

Setting up event handlers.



1 Although Event handlers are generally installed as part of add-in application we are not doing this so you will need to manually initialise the event handler. To do this, choose 'Insert > Module' to add a module sheet to your project.



2 Type this code into your new module:

```
Dim myobject As New
Class1
  Sub StartEvents()
     Set myobject.MyPPEvent =
Application
  End Sub
```

3 Choose 'File > Close and Return to Microsoft PowerPoint'. Now, before the event handler code will run you need to initialise it. To do this, run the StartEvents macro. Now starting a slide show, changing a colour scheme or double clicking a slide in Slide Sorter view will trigger your code to run.

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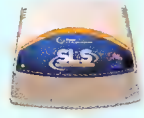
- tomatic Message dates by Internet or llular network
- ptional After Hours nnouncement

MESSAGE ON HOLD FOR SINGLE LINES

- Operates with standard phones
- Operates with cordless phones
- Optional Call Attendant facility
- Optional After Hours Announcement



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Video production on-the-go

Tom McNamara discovers that balancing size and power is a delicate process when building a specialist rig for content creation.

THE MISSION

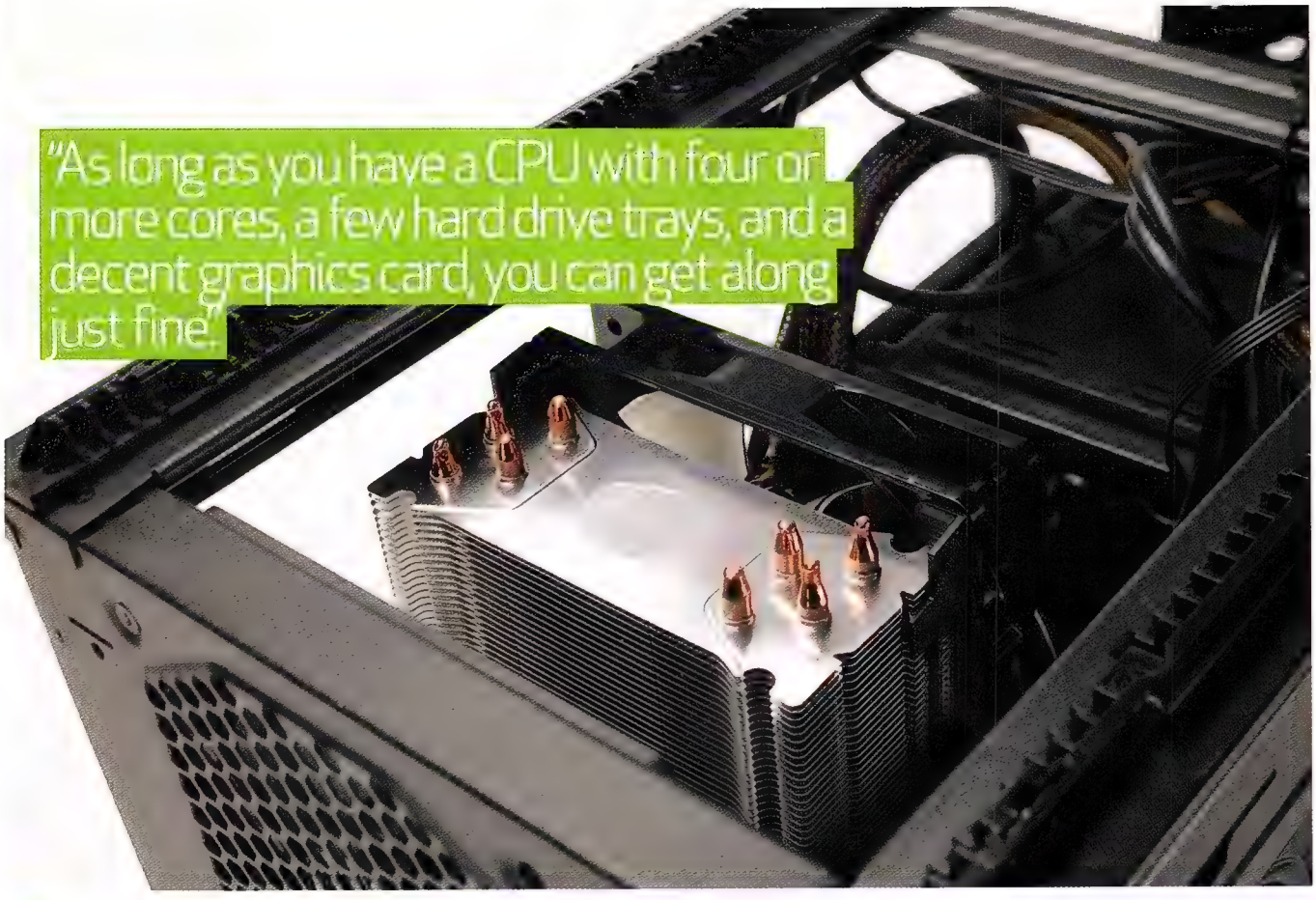
Sometimes we build systems to test out the latest hardware, or to experiment with different ideas. Here we're constructing a purpose-built machine with one usage case in mind - video editing. With YouTube, Twitch and other video sites becoming increasingly integrated into our daily lives, it's a good time to think about what we use to create this content, rather than what we use to watch it. And if you want to start your own YouTube channel or get involved with video creation, you don't need a super computer.

As long as you have a CPU with four or more cores, a few hard drive trays, and a decent graphics card, you can get along just fine. These bullet points are reasonable enough that we can fit them into a pretty low-profile PC that you can truck around without throwing your back out. With the type of case that we chose, you can also fit a full-sized power supply, high-performance CPU cooler and full-length graphics card in it without much hassle. This case is even designed to stack with multiple units of the same base model, giving you upgrade options further down the line.

AN EYE FOR ITX

We've built with 'shoebox' PC cases before, and they taught us that things can be a pain, due to their sheer compactness. Silverstone even ships some cases with power supplies pre-installed, along with custom shortened cables. They've a minimal footprint on your desktop and look cool, but woe betide you if you need to troubleshoot anything – you'll need to unpack entire chunks of PC guts to get at the problem, usually. So we wanted a shoebox that was reasonably easy to build into and out of. Especially with video encoding, where you want the ability to swap hard drives in and out. The Cooler Master HAF Stacker cases make those drives easy to access. You can also choose a case with the PSU mount on the front or on the back. We went with the front mount to keep the weight of the case balanced.

Inside this case we've used an ASUS RoG Maximus VII Impact mobo, which employs the Intel Z97 chipset and offers up a selection of its own handy features, too. We've kept costs down by putting an Intel Core i5-4670K CPU at the build's heart, and we've the ever-popular Cooler Master Hyper 212 Evo for some moderate overclocking. Our GPU is the Sapphire Radeon R9 285 Compact, which is roughly equivalent to a GeForce GTX 760. Our storage is a Samsung 850 EVO SSD and two 3TB hard drives from Seagate.



"As long as you have a CPU with four or more cores, a few hard drive trays, and a decent graphics card, you can get along just fine."

1 CART BEFORE THE HORSEPOWER

If you're using an aftermarket CPU cooler like we are on this occasion, you'll need to install its backplate on the motherboard before thinking about getting the board into the case. These ITX cases generally don't have cut-outs that enable you to access the motherboard tray from the other side. Thankfully, this is an easy task with the 212 Evo cooler.

For our LGA 1150 board, you choose the middle of the backplate's three screw positions, then put the mounting screws in, and fasten the screws on the other side of the board with the nuts that should be provided. Our board also has a tall riser card, so we needed to shift the CPU fan vertically a few notches to make sure that everything fit. Low-profile RAM is also something highly recommended.

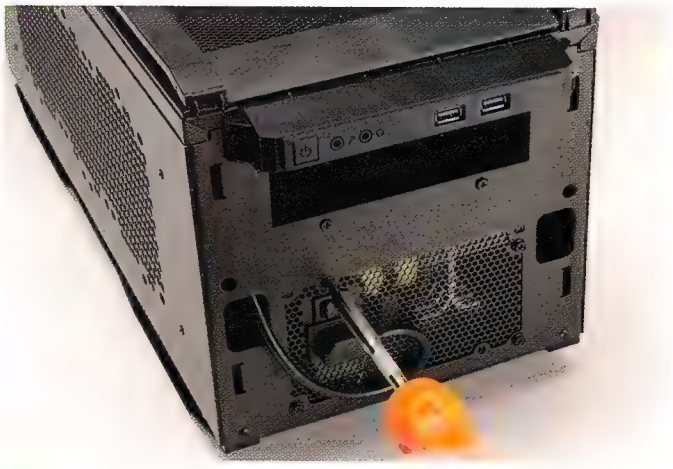
2 AIN'T THE SIZE OF THE BOAT

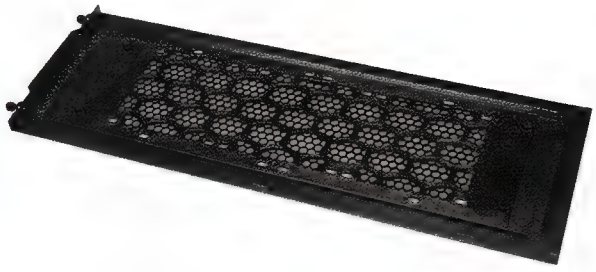
This Sapphire Compact graphics card is short enough for us to install this three-tray drive cage right in front of it. Without that, we're limited to the drive mount on the 5.25-inch bay (which is removable), the one below this drive cage, and the one on a reinforcement plate (which we removed for this build). This cage also has enough room behind it that we don't require right-angle SATA cables.

This case doesn't actually come with a 3.5-inch drive cage; you need to order the HAF Stacker 935 Storage Kit from Cooler Master to get it. The SATA cables that come with our motherboard aren't long, so we slapped them in, too. It doesn't matter which port you use on the motherboard end — they can all do SATA III speeds.

PARTS LIST

PART		PRICE
CASE	COOLER MASTER HAF STACKER 915F	$85
PSU	COOLER MASTER V550 550W	$119
MOBO	ASUS ROG MAXIMUS VII IMPACT	$319
CPU	INTEL CORE I5-4670K	$295
GPU	SAPPHIRE RADEON R9 285 COMPACT	$355
RAM	2X 8GB KINGSTON FURY BLACK	$185
DRIVE CAGE	HAF STACKER 935 STORAGE KIT	~$20
HDD	2X SEAGATE BARRACUDA 3TB	$260
SSD	250GB SAMSUNG 850 EVO	$340
OS	WINDOWS 8.1 64-BIT OEM	$129
TOTAL		$2,107





3 BACKWARDS AND FORWARDS

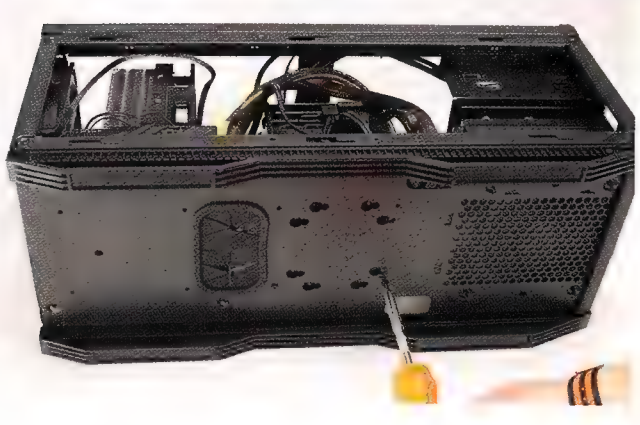
Here we have the front of the case with the bezel taken off. This right-angle power cable gets juice to the power supply while lying flat enough to fit behind the bezel. The PSU's power switch ends up on the inside of the case, which is a bit awkward. But the bezel pops off pretty easily, giving you access to the switch in a pinch. (We should also add that this is a pre-production version of the HAF Stacker, because we're hardware hipsters. Some cosmetic stuff is different from the retail version). The case has an intake fan below the PSU mount, and its heat is exhausted through the front of the case. Sometimes ITX cases make their PSUs expel heat into the case, which may cause overheating or lower your overclock ceiling. For our needs, this 550-watt unit is plenty. If you put in a 290 or 290X, we'd recommend bumping it up to 600 watts.

4 GETTING HIGH

This is what the inside of the HAF Stacker's side panel looks like. It has 'captured' thumbscrews, which means they stay attached even when fully unscrewed. It's basically one big grill with a bunch of fan mounts. You can mount two 140mm fans or up to three 120mm fans. In practice, you can't use all of these, because internal components get in the way. The top of the case has no fan mounts, but it's also one giant grill. In case you were wondering, HAF stands for "High Air Flow". Cooler Master aren't kidding. The other side panel is identical, so you can squeeze more fans in. We kept it simple and stuck with the 120mm stock exhaust fan. This ITX mobo has only two fan headers anyway, so we'd have to plug extra fans directly into the power supply, which can be noisy. On the other hand, you could use that 5.25-inch bay to install a fan controller, if you don't mind sacrificing the bay's drive mount.

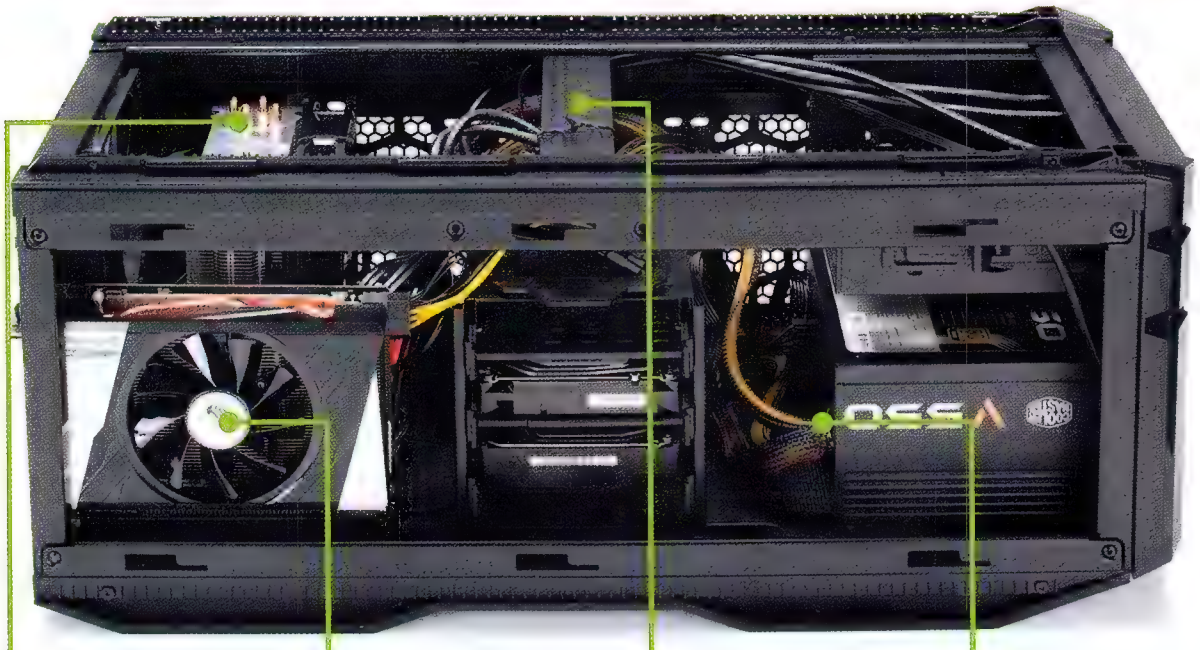
5 A LOVER, NOT A WI-FIGHTER

These two gold-plated coaxial connectors are for the motherboard's integrated Wi-Fi. You definitely want some of that in an ITX system, since it will have only one PCI Express card slot on the motherboard, and you want to use that for your graphics card. Since our system is designed for mobility, we don't want to have to rely on Ethernet for network access. These coax connectors each have a nut and a washer that you need to remove before putting the connectors through the back of the I/O shield here. You re-attach them on the other side, and your coax is secure. This ASUS motherboard comes with an antenna on a cable about two feet long, from which we were able to get a strong connection. Windows 8.1 recognised the adaptor right out of the box, which made our initial setup much easier.



6 TANGLES AND DANGLES

The underside reveals a couple of interesting things. Besides the drive mount, there's a set of rails and a rubber grommet. The rails give clearance for the power supply's intake. But you can also remove them and connect a second HAF Stacker. That's how the case gets its name. The grommet is for feeding data and power cables between the two cases, so they can share storage devices and a power supply. Three of these 915 cases stacked on top of each other will be roughly the height of a full ATX tower. Cooler Master also sells a '935' SKU, which combines this 915 with a 925 mid-tower that they don't sell separately. The 935 has Stacker attachment mounts both on top and on bottom, so you could build something pretty colossal.



1 You could actually squeeze a second CPU fan on the other side of the cooler, and the 212 Evo comes with an extra set of clips for that.

2 This Radeon R9 285 boasts just one fan, but doesn't generate much heat anyway. Even so, it performs better than the Radeon 280.

3 We put a twist tie here to secure the thick USB 3.0 cable coming from the front panel. You can also lift the case by this crossbar.

4 The PSU is 5.5-inches/140mm long. As you can see from the photo, you could go another half inch without meeting too much trouble.

It's a quiet riot

We made sure only one drive was connected when we installed Windows, otherwise it puts a system partition on a drive other than the SSD. We wanted to be able to swap out the other drives, and putting the system partition on one of them makes Windows unbootable if that drive is disconnected. While we were installing Windows, we noticed it didn't recognise the mobo's integrated Ethernet adaptor, which uses an Intel I218-V chip, even though it recognised the integrated Wi-Fi. We're used to the opposite being the case.

We used the Wi-Fi connection to download the Ethernet drivers, along with the latest versions of AI Suite (for managing fan speeds, monitoring temperatures and doing some tweaking), plus HomeCloud. We needed HomeCloud to enable Wifi GO, a feature that allows you to use your system as a wireless hotspot, which is a neat extra for our build. If your system boots without Ethernet or wireless connectivity, you can pull older drivers off a DVD bundled with the board, or you can download the drivers to a mobile device and transfer them via a USB cable. With just one 120mm fan in the case and another on the CPU cooler, this was a pretty quiet build. In fact, we actually removed a side panel to check the fans were spinning. Of course, the CPU fan cranks up a bit when the chip is firing on all cylinders, but it shouldn't be distracting. We took this opportunity to update the BIOS, since the newest one said it improved stability, and the one before claimed to improve performance. It's unfortunate mobo vendors are so vague about what their BIOS updates do. Either way, we couldn't resolve an issue where the PC wouldn't boot when we had a USB thumb drive plugged in.

Since we're not testing new hardware, there aren't any benchmarks to run. This build was more about concept and execution. The results will vary a lot according to what kind of video footage you're dealing with and what programs you use to edit and encode. But the Radeon R9 285 is on Adobe's approved list for hardware-accelerated encoding via OpenCL, and four Haswell CPU cores pack plenty of performance poke, too.

By default, this ASUS motherboard will set all cores of the Core i5-4670K to 3.8GHz, when a load is applied. That's the CPU's official maximum "Turbo" setting. Without this motherboard setting, one core will run at 3.8GHz when only one core is being used. When all four are in action, they'll run at 3.5GHz each. When three are being used, they'll run at 3.6GHz each; for two, they'll run at 3.7GHz. The motherboard's "Sync All Cores" setting streamlines this business and gives you a performance edge for video encoding, which typically uses all the cores and threads that you can throw at it.

If you have some downtime, this system doubles as a respectable gaming rig. We averaged 79fps in *Tomb Raider*, using the "Ultimate" setting at 1,920 x 1,200 with TressFX disabled. The *Hitman: Absolution* benchmark averaged 48fps on Ultra with 4xMSAA. This compact 285 retails at a higher price than average, so it's not the best bang for your buck, but it's the best value after you've factored in size. Nvidia's partners have started coming out with mini versions of the GeForce GTX 970, but those are about $120 more.

Overall, we're happy with how this system turned out, though we might have opted for a less expensive motherboard, since the Maximus VII Impact is designed to take advantage of more exotic CPU cooling than a Hyper 212 Evo. ■

Google's Chromecast media streamer can now screen-cast your Android screen.

Casting everything to Chromecast

Learn how to stream any content from anywhere to your Google Chromecast dongle. Darren Yates explains how.

Last month, we took the long handle to Google's Chromecast, hacked it solidly and loaded on the custom Eureka v22062 ROM – the main reason for doing so, to play Netflix US content natively on the device. Unfortunately, the hacking process not only requires you have a brand-new-in-box Chromecast never before connected to the web, it must come with the right firmware version and you also need an Arduino microcontroller board to get the dongle's leaky bootloader to switch into a kind-of/sort-of recovery-mode for installing the ROM. Granted, it certainly wasn't a simple hack and needed some white-knuckle courage and the patience of a saint to complete, but it could be done.

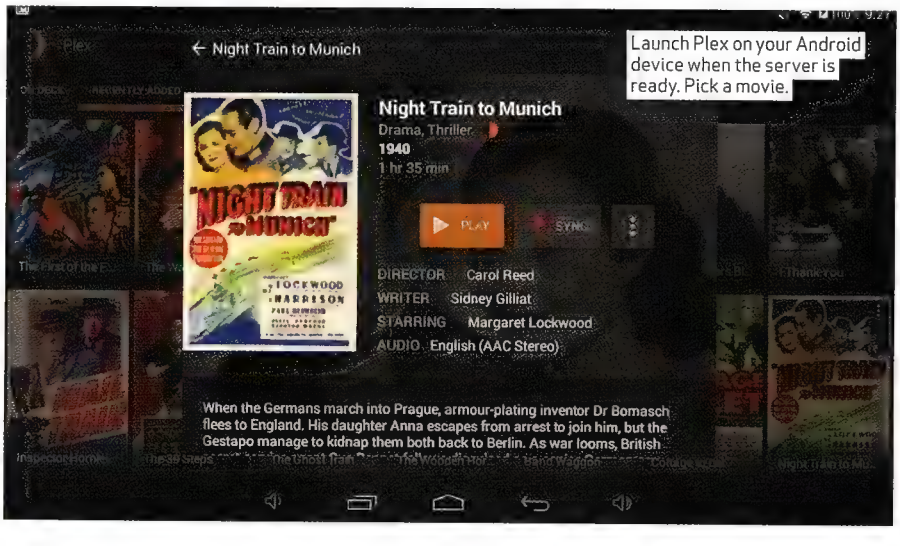
But if you already have an non-hackable Chromecast, native Netflix US content playback might be out of the question, but that doesn't mean Netflix US content on an Australian Chromecast is impossible. In fact, with the right setup, you can jury-rig a solution for virtually all of your media, whether local or streamed – wherever it comes from.

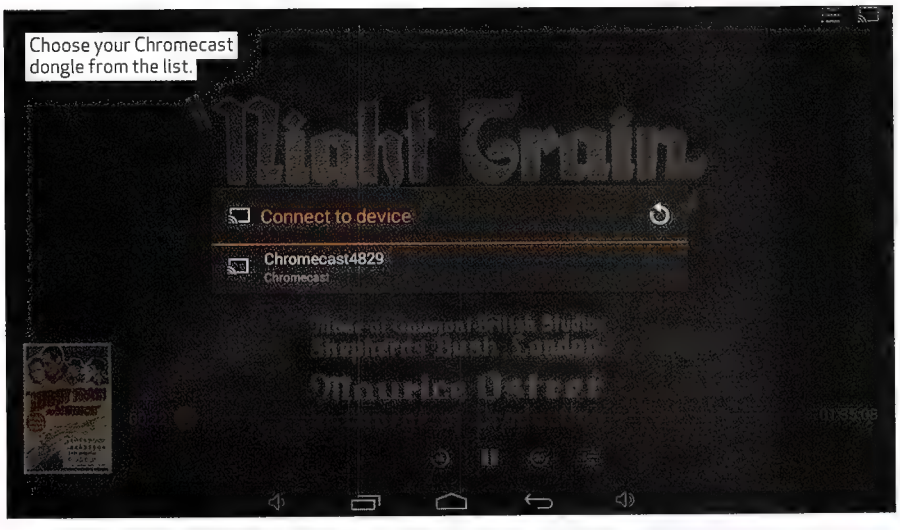
SCREEN CASTING FROM ANDROID

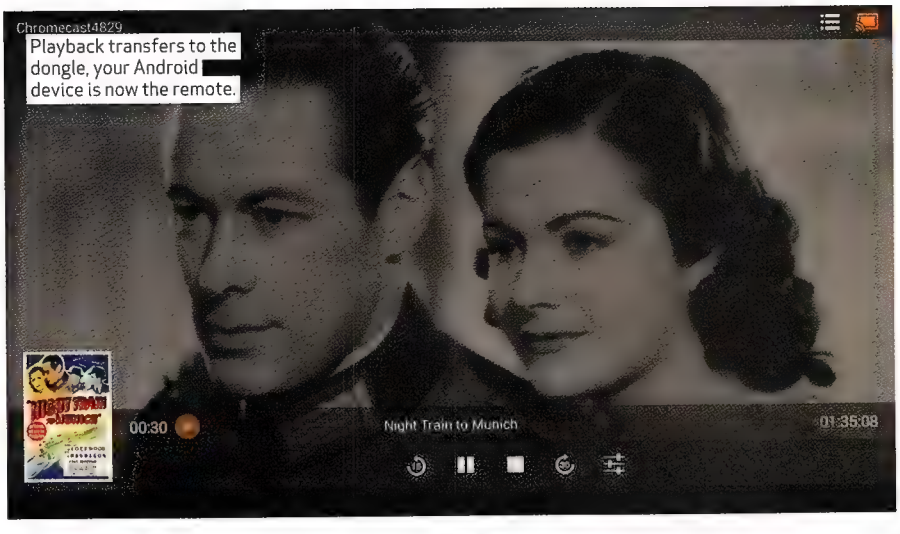
Google continually tweaks its Chromecast features list and one new recent addition is the ability to mirror the screen of certain Android devices to the dongle for display on your TV screen – the Chromecast version of Miracast, if you like. You'll find the current list of Android devices support screen-casting on the Chromecast support page (**tinyurl.com/lwj72lx**). If your device isn't there, don't stress – it's not an exhaustive list and the word is a bigger list is on the way. What you do need is a Chromecast dongle with the latest update (including hacked dongles with the latest Eureka ROM) and an Android device with 4.4.2 or later. Google says the feature is only in beta at the moment and only works on Android devices – iOS and Windows devices need not apply.

But as something of a compatibility guide, we purchased a brand-new unopened 7-inch PendoPad PNDPP44Q7GPBLK tablet with KitKat/Android 4.4.2 and quad-core Allwinner A31 Cortex A7 CPU for $30 from our local supermarket just before Christmas last year.

It's not on the Google support list, but we had no trouble hooking it up to the


Plex
← Night Train to Munich
Launch Plex on your Android device when the server is ready. Pick a movie.
Night Train to Munich
Drama, Thriller
1940
1 hr 35 min
PLAY
SYNC
DIRECTOR Carol Reed
WRITER Sidney Gilliat
STARRING Margaret Lockwood
AUDIO English (AAC Stereo)
When the Germans march into Prague, armour-plating inventor Dr Bomasch flees to England. His daughter Anna escapes from arrest to join him, but the Gestapo manage to kidnap them both back to Berlin. As war looms, British





Chromecast dongle, with screen-casting working perfectly through the Chromecast app. The same couldn't be said for my Samsung Galaxy S3 phone running CyanogenMod 11/Android 4.4.4 though – it tried but crashed repeatedly, which suggests you need a device with KitKat or later preinstalled (the Galaxy S3 supports Miracasting via Netgear's PTV3000 Miracast adapter on Jelly Bean/Android 4.1-4.3, but better on 4.1 than 4.3, we think due to 4.3's extra load).

Setting up screen-casting is pretty straightforward – make sure your Android device and Chromecast are plugged in, turned on and connected to the same network. Fire up the Chromecast app on your Android device (download it from Google Play if you haven't already), select Cast Screen from the menu app, select the Chromecast device and within a few seconds, you should see the mirror of your Android screen appear on your television.

We found the mirror speed fast enough to handle audio/video playback with our $30 quad-core tablet, from both local storage and file-streamed from my Windows home server. We're not certain whether dual-core tablets will have the CPU power to do the same job, although if there is a performance hit, it'll likely work better with SD (standard-definition) rather than 1080p/HD content.

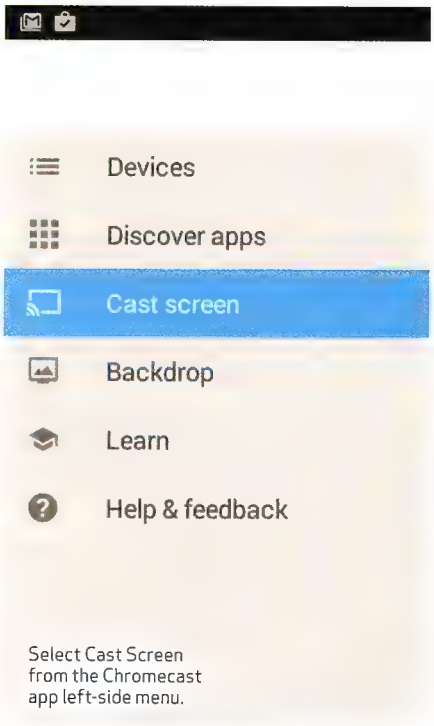
CASTING LOCAL VIDEO

Once you have screen casting in operation, playing local video content becomes as easy as firing up your favourite media player. Right now, it seems the battle of the media players is between our perennial favourite, MX Player, and the long-awaited arrival of VLC for Android 1.0. Both have excellent video codec support, but VLC also supports the latest codecs such as H.265/HEVC video and recent Opus audio codecs. Both of these apps are available for free on Google Play. Make sure you grab the MX Player Codec Pack for maximum codec playback support – you want the ARMv7 version for most modern devices running an ARM Cortex-series processor. Chromecast screen-casting also takes care of the audio, so there's no need for separate audio connections.

CASTING NETWORK CONTENT

But the screen-casting feature also works with your local networked media content – and you can do it with free software and a standard (non-hacked) Chromecast dongle. All you need is ES File Explorer file manager. The beauty of ES File Explorer is that it will use CIFS/Samba Windows network protocol to stream media files across your Wi-Fi network to your Android device, which decodes and plays the files, but then re-stream the video back over the Wi-Fi network to the Chromecast dongle.

We tested this accessing content on a Windows 8.1 home server which had standard username/password login. Install ES File Explorer if you haven't already done so, launch it and select LAN from the left-side menu. From the bottom-row menu, choose Scan and allow it to search out the devices on your network. Once your server is found, select it – enter your login details into ES File Explorer when asked and you'll get limited access to the server system (basically only Users folders are accessible on Windows 8.1).



Select Cast Screen from the Chromecast app left-side menu.

From there, select a video file and Android will give you a choice of media players to use. MX Player is the preferred choice for its wide codec support, but once your choice of player is selected, you should be on your way.

Just one other sidepoint, if you're having trouble playing AVI files, try that MX Player codec pack and switch to software decoding (top-right of playback window) – some Android players will open the AVI file container, but we've found MX Player's software decoding will handle most of the codecs inside them as well.

CASTING NETFLIX US CONTENT

Hacking a new-in-box Chromecast dongle and loading it with the Eureka ROM is the only way for now to get the native Netflix US app onto the device, but if your Chromecast can't be hacked, it's not the only way to get Netflix US content streaming to it.

We've explained before how to use DNS rerouting services such as Unblock-us.com (**unblock-us.com**) to bypass geo-blocking and force Google Play to push the Netflix US app onto your Android device. If you're still not sure, read up on it from our web site at **apcmag.com/how-to-use-android-to-watch-netflix-australia.htm**.

Once you have geo-block bypassing and the Netflix US app up and running, you can again use the screencasting feature to cast the Netflix US display to Chromecast and your TV over Wi-Fi. We had it working on our $30 quad-core tablet with smooth video playback and no obvious frame dropping at SD resolution. That said, there was a minor delay in the audio, which is possibly due to the fact that the data stream must come to your Android device via a DNS rerouting service and go back out the same way to your Chromecast device. Depending on where your DNS server is located, that could be quite a distance. Bottom line, the overall performance will depend on the distance to that DNS server, the speed of your network and the speed of your Android device's CPU. Or in other words, your mileage may vary.

STREAM TO CHROMECAST VIA PLEX

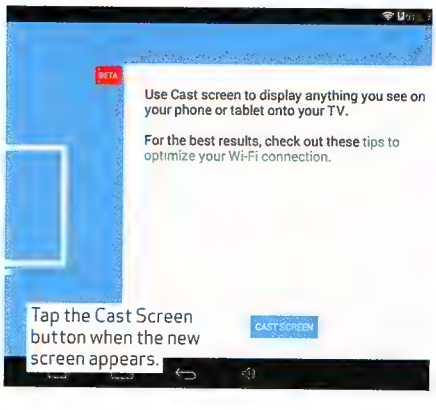
But if you have a Chromecast dongle, the best way to stream your local and network content to the device is via Plex for Android. Plex has been around for a while on Android but it also has a native Chromecast app you control via the Android app. The Plex Android app will cost you US$5, but the server-side app is free – it's also available for Windows, Mac OS X, Linux and, more recently, FreeBSD operating systems. Download the app onto your Android device and grab the appropriate server app for your home media content library – we used the Plex server app on a Windows 8.1 home server. Once it's installed, it'll automatically fire up your web browser and launch Plex's Media Manager web interface on localhost (127.0.0.1:32400). You'll also find a new Plex icon in the System Tray.

If you've not used the Plex server app before, when you hit the Media Manager, you'll see a plus sign '+' next to your server name at the top-left of the window. Click on the plus symbol and it'll launch the Add Library window. Select a media library type – Movies is a good place to start. Click Next on the next screen and choose the Add Folder button on the following window. Select the folder location of your movies directory from the following window and press the Add button. That will return you back a screen – choose the Add Library button, sit tight and wait as Plex rounds up the media content in that folder. By default, Plex also heads out and brings back movie poster display tiles for your movies it knows about. When it's complete, repeat this process for your music library and the server is pretty well good to go.

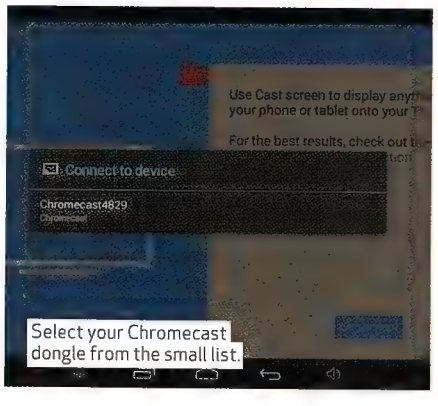
Now head back to the Plex app on your Android device and make sure you have the Chromecast dongle plugged into your telly and powered up. Select the 'Recently Added' tab and you should see your movie list. Choose a movie and press the Play button – within a second or two, your movie will begin playing on your Android device. But up in the top-right corner, you'll see the Chromecast cast icon – tap on it, select your Chromecast device and that will trigger Chromecast to load the native Plex app and take over playback of your movie on your TV. From now on, Chromecast is talking to your Plex server directly, with your Android device just working as the remote control – you can test this by simply shutting down your Android device and the movie will keep playing. We saw no audio delay on Plex, which lends weight to the idea that global DNS shifting can push things just a little out of kilter.

BACKDROP YOUR PHOTOS

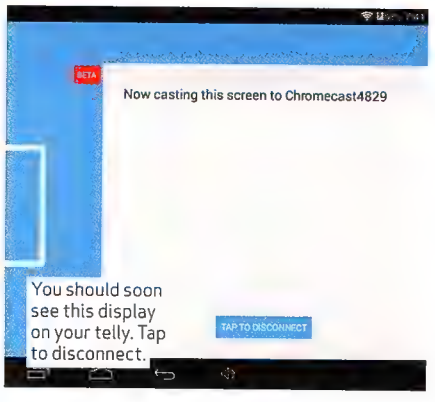
One last recent arrival on Chromecast is the new Backdrop function – this allows you to stream photos stored on your Google+ account direct to the dongle for play on your TV as a backdrop. Again, the process is pretty simple – fire up the Chromecast app, select Backdrop from the app menu. If you're not hooked up to the dongle, select it and then use the menu button top-right of screen to select the


BETA
Use Cast screen to display anything you see on your phone or tablet onto your TV.
For the best results, check out these tips to optimize your Wi-Fi connection.
CAST SCREEN

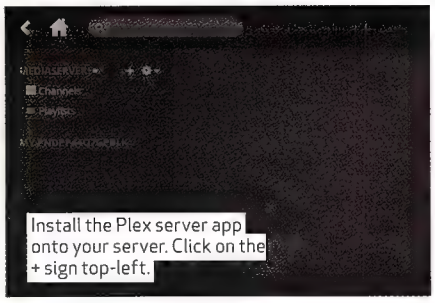
Tap the Cast Screen button when the new screen appears.



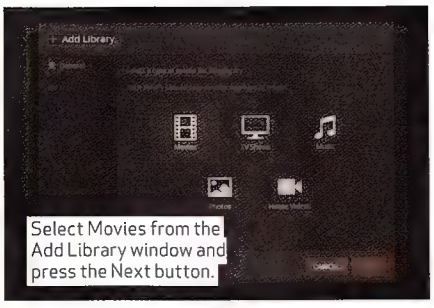
Select your Chromecast dongle from the small list.



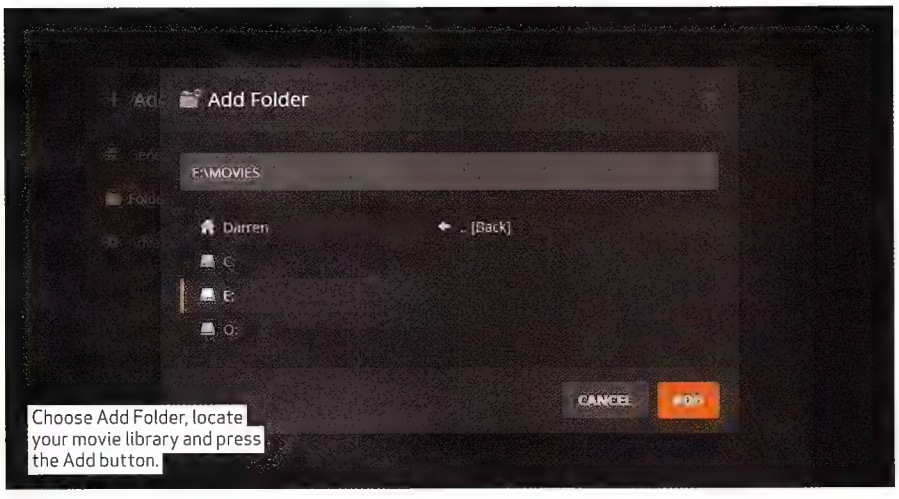
You should soon see this display on your telly. Tap to disconnect.



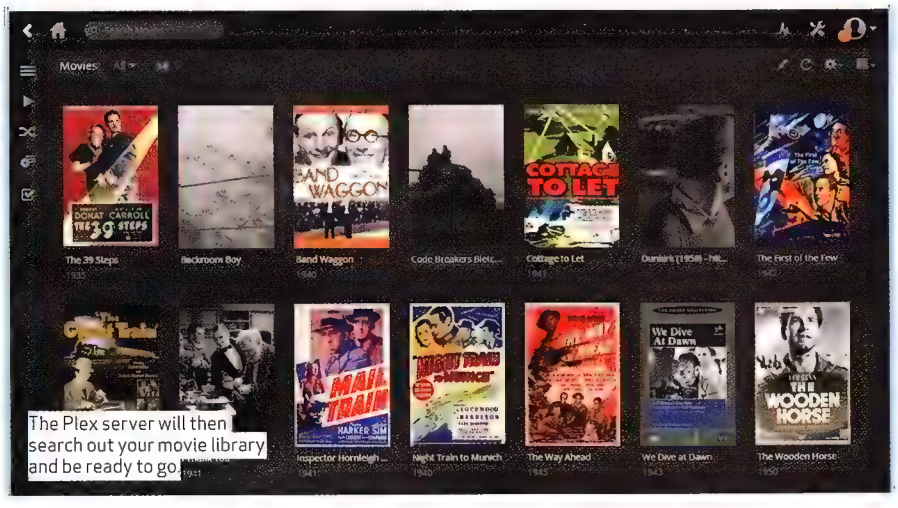
Install the Plex server app onto your server. Click on the + sign top-left.



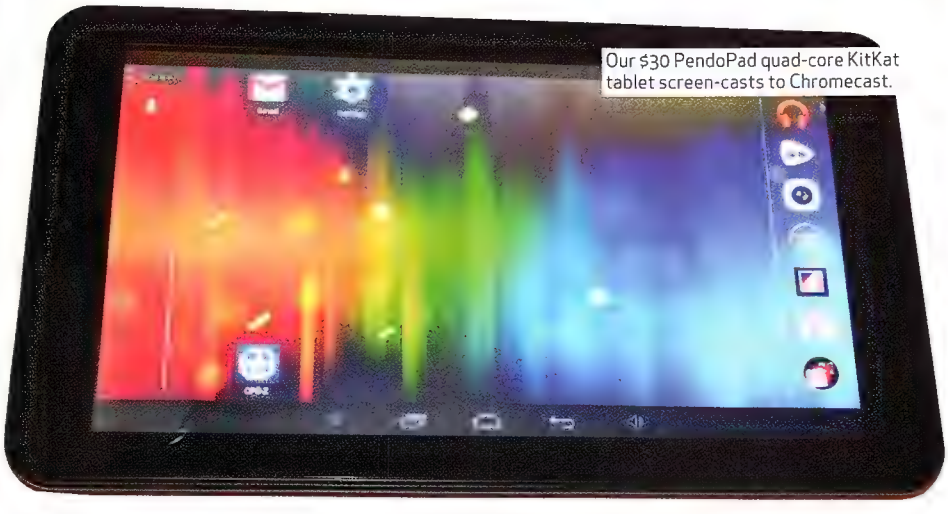
Select Movies from the Add Library window and press the Next button.



Choose Add Folder, locate your movie library and press the Add button.



The Plex server will then search out your movie library and be ready to go.



Our $30 PendoPad quad-core KitKat tablet screen-casts to Chromecast.

Backdrop Preferences menu. You'll be asked to allow the Chromecast app to access your Google+ account photos. Click yes if you want this and set what gets backdropped to your dongle. You can choose photos from your Google+ stream or just your own photos. Once set, Chromecast will create a slideshow on rotation.

CHROMECAST OR MINI PC?

It's certainly annoying that Chromecast can't natively load the Netflix US app without starting from a new-in-box model and hacking the daylights out of it. But overall, Chromecast is surprisingly simple to use and without the need for a media circus sitting behind your TV. Still, personally, I also like having something a little more versatile plugged into the telly in the form of a mini PC, which gives you a full mini dual-core computer or better with Android 4.2/Jelly Bean minimum, on which, you can run any Google Play app you like — including the Netflix US app (with the usual geo-block help) — and for around the same price as Chromecast. ■

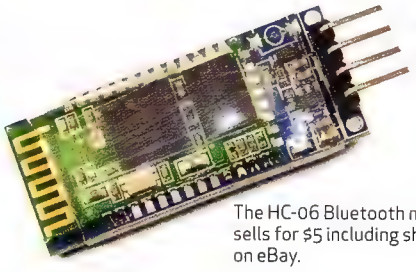
Chromecast hack running out of time

At the time we performed the ROM hack on our Google Chromecast dongle, retail versions available in Australia shipped with an older version 15xxx ROM. Google fixed the bootloader vulnerability that enabled custom ROM installation in firmware build 19084. That means it is inevitable Chromecast dongles will eventually reach the market with firmware 19084 or later pre-loaded — when that happens, the bootloader hack will no longer work and unless another way in is found, Chromecast will no longer be hackable.

However, the word from XDA-Developers (**forum.xda-developers.com/showthread.php?t=2537022**) is that dongles with serial numbers beginning '3922' are around the cut-off period for Google changing to firmware that is no longer rootable. The talk is also that Canadian and European versions launched in March 2014 with serials starting at '41xx' were also not rootable. That said, the one we purchased in Sydney just before Christmas last year started with serial '4327' and had a firmware version 15xxx on-board. Using the method we outlined last month, we were able to gain root access and update the ROM to Eureka's latest version 22062.

Make your own Internet of Things

Darren Yates shows you how to add Bluetooth wireless connectivity to your Arduino projects and make your own IoT gadgets.



The HC-06 Bluetooth module sells for $5 including shipping on eBay.

The Internet of Things has well-and-truly reached buzzword status and everyone is making all sorts of gadgets designed to hook into your phone or tablet – as well as the internet. But don't think you'd need a multinational corporation with a stratospheric budget – you can do it yourself for about $25.

BLUETOOTH MODULE

The key is a tiny little Bluetooth module called the HC-06 that you can pick up on eBay for as little as $5 including shipping. Like any other Bluetooth-ready device, it can sync or 'pair' with your Android or iOS phone or tablet, even your PC or notebook with a suitable Bluetooth transceiver. We're going to take a quick look at how it works by combining it with the DHT22 temperature/humidity sensor from last month's Arduino Basics masterclass to create a simple remote weather station you can read using a free Android app.

BUILDING THE PROJECT

Here's a quick list of what you need to build this project:

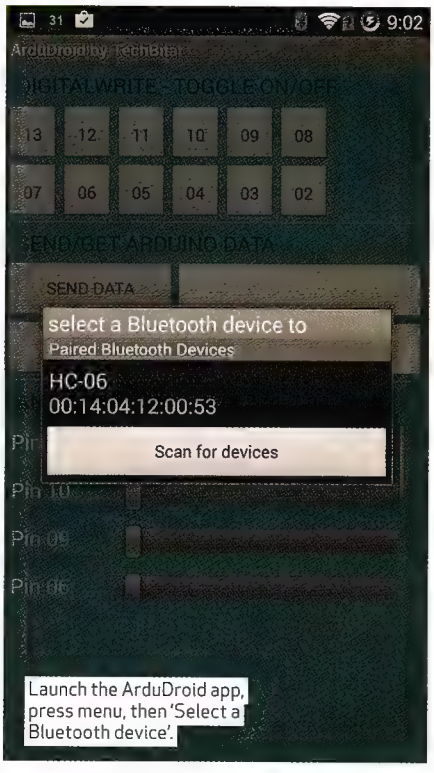
- Arduino Uno R3 microcontroller board
- DIY prototype shield
- 4.7k-ohm 0.5-watt resistor
- 10k-ohm 0.5-watt resistor
- DHT22 sensor
- HC-06 Bluetooth module
- About 10 Dupont breadboard wires

Follow the overlay diagram to build up the project and the circuit diagram tells you how it all works. Grab the Arduino source code from our web site at **www.apcmag.com/magstuff**, load it into the Arduino IDE (you can get this from **arduino.cc/download**), compile it and flash it to the Arduino board. Plug the DIY prototype shield into the board and power it up. If you keep the USB cable plugged into your PC, press the Monitor button top-right of the IDE window, set the Serial port speed at the bottom-right of the Serial Monitor window to '9600' and you should begin to see temperature and humidity readings.

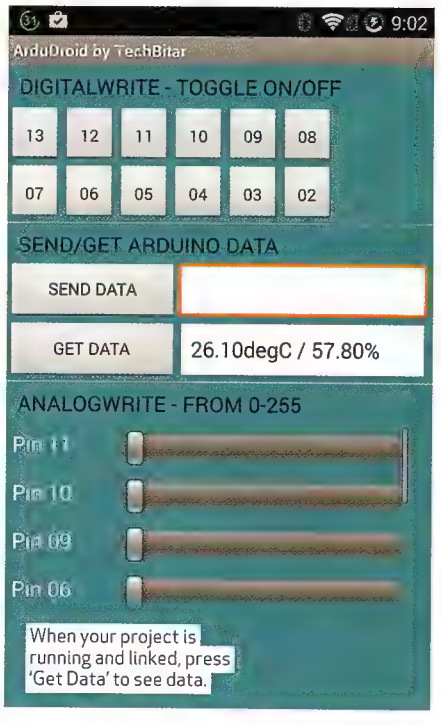
The reason for the two resistors is that we need to do some very basic voltage-level translation – the Bluetooth module runs off 3.3VDC, but the Arduino I/O pins are 5VDC. We make a simple voltage divider using the resistors to drop the Arduino I/O pin voltage from 5VDC to 3.4VDC, which is close enough to 3.3VDC.

GETTING THE ANDROID APP

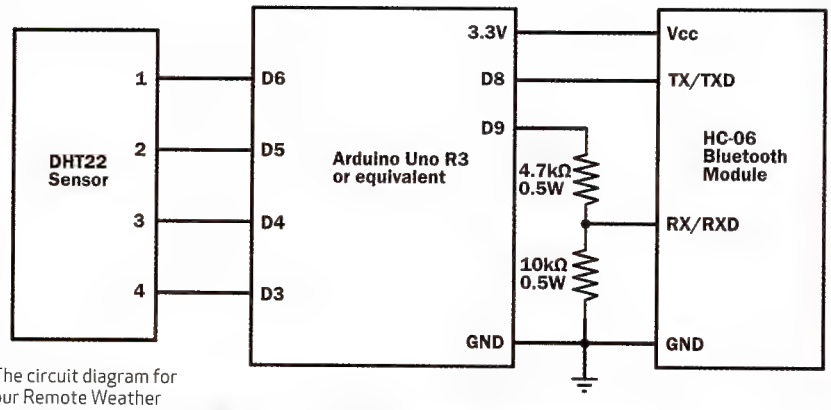
To communicate with the Bluetooth module, you'll need a Bluetooth-ready Android phone or tablet and the free ArduDroid app from Google Play. Download it, install it. Power up the project and go to your Bluetooth options in the Android Settings menu



Launch the ArduDroid app, press menu, then 'Select a Bluetooth device'.

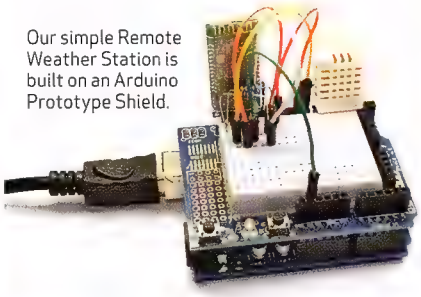


When your project is running and linked, press 'Get Data' to see data.

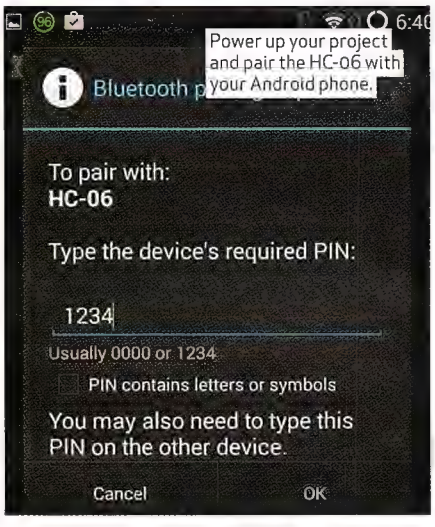


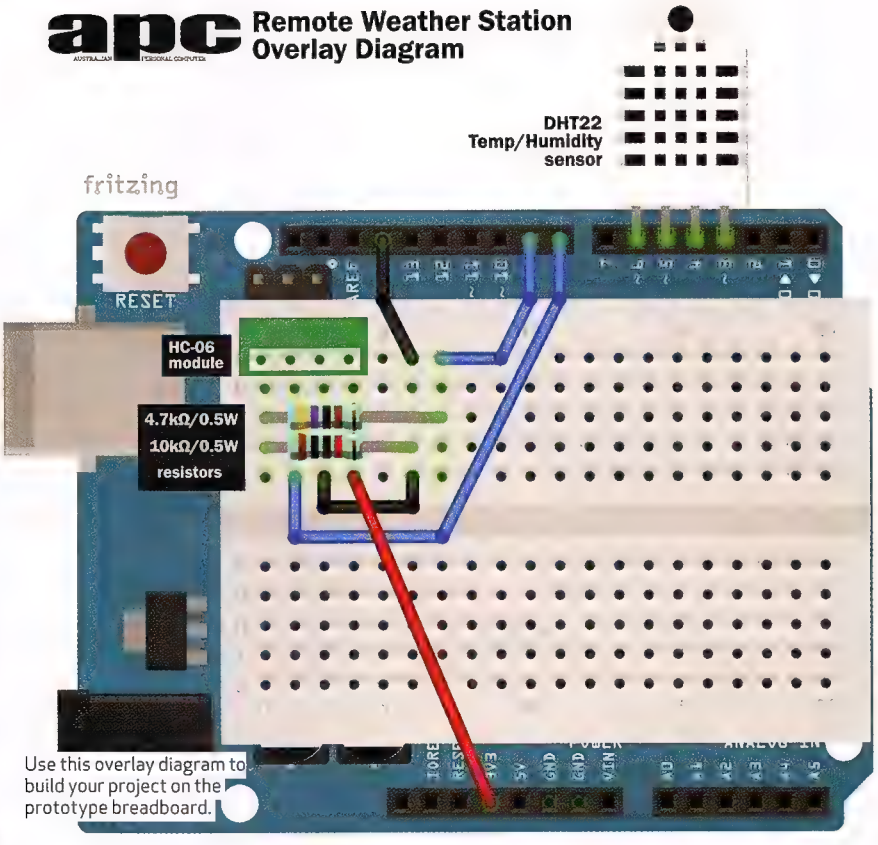
The circuit diagram for our Remote Weather Station project.

apc Remote Weather Station



Our simple Remote Weather Station is built on an Arduino Prototype Shield.


Power up your project and pair the HC-06 with your Android phone.
Bluetooth p
To pair with:
HC-06
Type the device's required PIN:
1234
Usually 0000 or 1234
PIN contains letters or symbols
You may also need to type this PIN on the other device.
Cancel
OK



and pair up to the Bluetooth module, which should appear as 'HC-06' in the 'available devices' list. When you're asked for it, the password should be '1234'. When that's done, launch the ArduDroid app, press the menu button and tap on 'Connect me to a Bluetooth device'. When you see the HC-06 module listed in the new window, tap on it. This should take you back to the main app window and if you now look at the HC-06 module on your project, the red LED that was flashing should now be lit solid, indicating it's linked to your device.

Tap the 'Get Data' button on the ArduDroid main screen and you should see the temperature and humidity data now appear. Data readings are taken one per second, so tap the button again to get the latest. Bluetooth is only good for up to around ten metres, so make sure you're quite close initially, just to make sure the project is working correctly.

HOW THE CODE WORKS

In order to see output on the Serial Monitor and communicate with the Bluetooth module at the same time, we've incorporated the AltSoftSerial library to handle the HC-06 module while the Arduino's hardware serial port talks to the Arduino IDE and your PC.

To cut down on the wiring, we're also using our trick from last month of powering the DHT22 sensor via the Arduino digital I/O pins. We do that with the DHTvcc, DHTdat, DHTgnd pinMode writes inside the setup() method. (Remember, in Arduino, the setup() method runs once before handing over to the loop() method, which loops until the power is removed).

The last thing the setup() method does is to initialise the sensor and indicate to the Serial Monitor whether the sensor is working correctly or has a problem.

BLUETOOTH DATA TRANSFER

When you press a button on the ArduDroid app, it transmits a character string to the Bluetooth module, which reads it one byte at a time. So the first thing we have to do is check whether there is any data available using the arduinoBT.available() method:

```
IF (ARDUINOBT.AVAILABLE()) {
```

If no data is available, we send the Arduino code around the loop again – we wait one second (1000 milliseconds), take a temp/humidity reading and check if the Bluetooth module has received any data.

When that if-statement is true, we then read the first available character and check to see if it's the start-command character '*'. If it is, we read the command byte, the pin byte, followed by the pin-value byte. The form of the bytes received is *-10-99-99-#.

Because we want the Arduino to transmit back the current temp and humidity levels, the only byte we're interested in is that pin byte. If that pin byte is '99', the app's 'Get Data' button has been pressed, requesting the temp and humidity readings. We send the latest readings back using the AltSoftSerial library's 'print' command, which is more like the standard Serial. print and much easier to use than reading incoming bytes.

We print the data from variables DHTtemp and DHThumid to the 'ArduinoBT' software serial port connected to the Bluetooth module, it transmits the data, the Android device's Bluetooth module picks it up and displays it on the app.

GIVE IT A GO

Using a Bluetooth module with Arduino is pretty much just setting up a wireless serial port – it's a matter of reading bytes coming in that usually indicate a data request from a phone or tablet app and sending back the required data as text using the Serial. print function.

The top data transfer speed is actually set by the Arduino and the AltSoftSerial library to 57600 bytes per second (bps). The Bluetooth module itself defaults to 9600bps, which is old dialup-modem territory, but still fine for basic text and control data transfer like we're using here. Not bad for $25 ■

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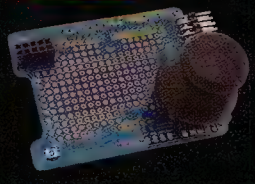

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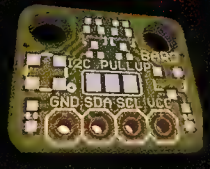

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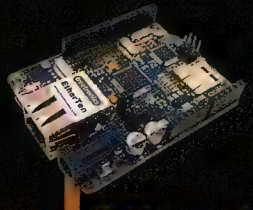

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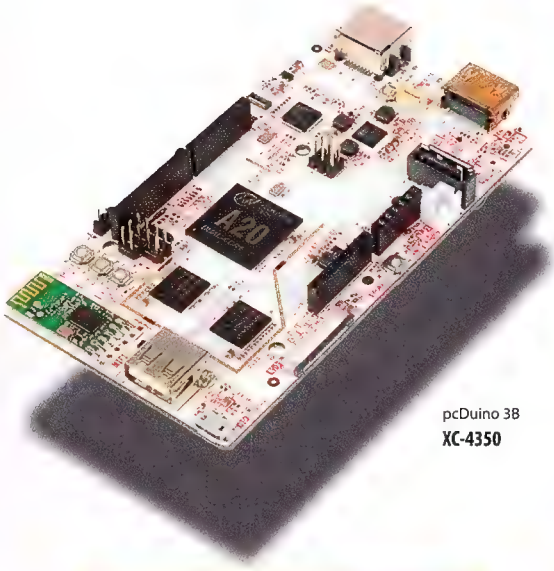

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XC-4350

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SDRAM	1GB	1GB
Flash Memory	4GB Flash	4GB Flash
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Audio Output	3.5mm Analogue	**3.5mm Analogue I2S Stereo Digital**
Onboard OS	Ubuntu 12.04	Ubuntu 12.04
Supported OS	Android 4.2 (ICS) / Linux 3.0	Android 4.2 (ICS) / Linux 3.0
Extension Interface	Arduino	Arduino
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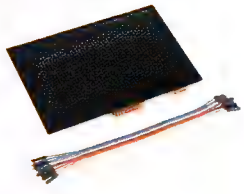

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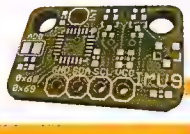

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Part 6 – Arrays and ArrayLists

This month, Darren Yates looks at how to store more than one value at a time in your code using two different techniques.

Back in Part 2, we looked at how we can store values in our programs by replacing them with symbols called variables. Variables are brilliant, but the trouble is they only store one value at a time. What if you want to store ten values? Or a hundred? Having to code up 100 variables to store 100 values would make for messy code in no time flat and keeping track of them would be a nightmare! But as you'd expect, there's a simpler way, using a data structure called an 'array'.

INDEXED VARIABLES

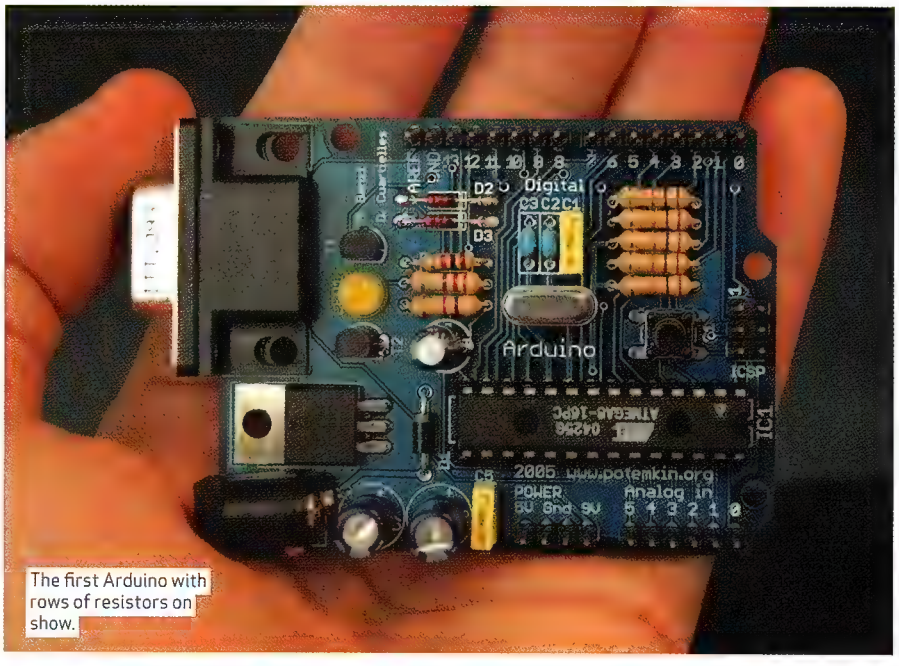
An array is a collection of what are called 'indexed variables'. So far, we give a variable a name or symbol and we store one value in it. If we make that variable an array instead, we create a number of same-type variables that can be accessed by the one symbol and an index. Clear as mud? Let's try an analogy – if you live in an apartment block, you don't just live in the apartment block, but in a separate apartment, which has its own number. The block has its own address and each apartment is referenced or indexed by the apartment number. You may live in unit 1, the noisy guy playing the Van Halen solos in unit 5. Arrays are a similar concept.

To use an array, first, you must declare it by coding its data type and name, then initialise its values. For example, we could declare an array of card suites like this:

```
String[] cardSuites = new String[4];
```

We tell Java to create a new String array with four elements (new String[4]) and assign it (=) to a new String array (String[]) variable called 'cardSuites'. We can now add data to each element in the array like this:

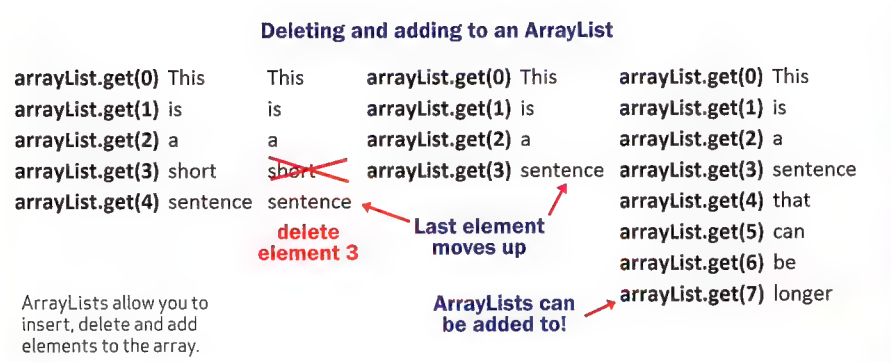
```
cardSuites[0] = "hearts";
cardSuites[1] = "diamonds";
cardSuites[2] = "clubs";
cardSuites[3] = "spades";
```

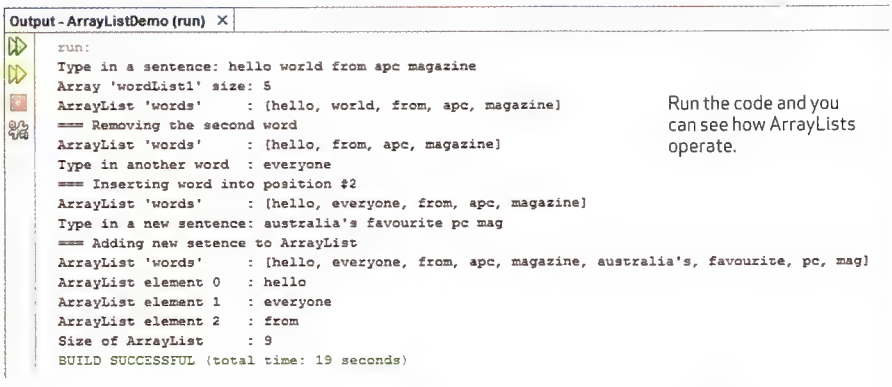


The first Arduino with rows of resistors on show.

The start of our ArrayList app code shows how to declare an ArrayList.

```
package arraylistdemo;

import java.util.ArrayList;
import java.util.Arrays;
import java.util.Scanner;

public class ArrayListDemo {

    public static void main(String[] args) {

        ArrayList<String> words = new ArrayList<>();
        Scanner input = new Scanner(System.in);
        System.out.print("Type in a sentence: ");
        String sentence = input.nextLine();
        String[] wordList1 = sentence.split(" ");

        words.addAll(Arrays.asList(wordList1));

        System.out.println("Array 'wordList1' size: "+ wordList1.length);
        System.out.println("ArrayList 'words'     : "+ words);
        System.out.println("=== Removing the second word");
        words.remove(1);
        System.out.println("ArrayList 'words'     : "+ words);

        System.out.print("Type in another word  : ");
        String newWord = input.nextLine();
        System.out.println("=== Inserting word into position #2");
        words.add(1,newWord);
        System.out.println("ArrayList 'words'     : "+ words);
```




Output - ArrayListDemo (run)
run:
Type in a sentence: hello world from apc magazine
Array 'wordList1' size: 5
ArrayList 'words' : [hello, world, from, apc, magazine]
=== Removing the second word
ArrayList 'words' : [hello, from, apc, magazine]
Type in another word : everyone
=== Inserting word into position #2
ArrayList 'words' : [hello, everyone, from, apc, magazine]
Type in a new sentence: australia's favourite pc mag
=== Adding new setence to ArrayList
ArrayList 'words' : [hello, everyone, from, apc, magazine, australia's, favourite, pc, mag]
ArrayList element 0 : hello
ArrayList element 1 : everyone
ArrayList element 2 : from
Size of ArrayList : 9
BUILD SUCCESSFUL (total time: 19 seconds)
Run the code and you can see how ArrayLists operate.

A couple of things to notice here – first, the use of square brackets [] rather than curly ones to indicate the index; and second, the index always starts from zero.

APP #1 – RESISTOR COLOUR CODE CALC

OK, enough theory – let's do something with it. One of the first things you learn when studying electronics is the resistor colour code. After a while, you learn it by heart and it makes identifying resistor values as easy as looking at the colour bands. But when you're just starting out, it can be confusing and easy to make mistakes. That's where a simple app can make things easier. We'll solve this techie problem using an array.

First up, you can see the how the resistor colour code works in the chart. The resistor shown has five coloured bands – the first three indicate the first three digits of the resistor value, the fourth the 'multiplier', the fifth, the 'tolerance'. Many resistors have just four colour bands with the third digit band missing.

In the case of the resistor shown, we get the colours brown, black, black, red, brown reading from the end the bands are closer to. Using the code chart, we have '100' as the first three digits, a 'x100' multiplier and a '+/-1% tolerance'. To work out the resistor value, we get 100 x 100, or 10,000-ohms (10k$^{\Omega}$) and the tolerance means the value must be between 9900 and 10100-ohms.

STICK TO THE CODE!

Now let's look at our Java code. After we declare the class 'ColourCode', you'll see that we declare and initialise a String array called `digitColour`. The difference here is we're using a common shortcut known as an 'array initialiser'. Remember before how we declared the array first and initialised it in separate code-lines? The array initialiser allows you to do it all in the one line:

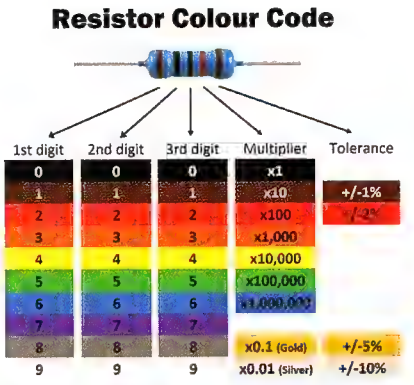
```
static String[] digitColour =
{"black","brown","red","orange"
,"yellow","green","blue","purpl
e","grey","white"};
```

This is a string array called `digitColour` and each indexed variable is filled in turn with one of the comma-separated strings between the curly braces on the right of the equals (=) sign. What you get is `digitColour[0]` gets assigned 'black', `digitColour[1]` 'brown' and so on down to `digitColour[9]` as 'white'.

Next, we now launch into the app using the `main` method and ask the user to enter in a resistor value between 10 and 10 million ohms. But following on from our look at methods last month, we also introduce a second method called `getColour` that has an integer parameter called `ohms`.

Look at the last codeline of the main method – it's a basic 'println' statement but right at the end, we're pausing the main method to start or 'call' the `getColour` method and sending it the value in the 'ohms' integer variable, the number typed in by the user previously.

Here in this new method, we first initialise a string variable called `code`,



The basic resistor colour code is ripe for coding using an array.

then we get the first two digits of the number the user typed in and store them into integer variables `digit1` and `digit2`. The two codelines that obtain these values look completely different but they actually deliver the same result – we're just showing you two different ways to get there. The first turns the integer value of ohms into a string, grabs the first character as a sub-string and converts that back into an integer. The second turns the 'ohm' integer value into a string, but this time, grabs the second character (index '1') as a 'char' type value and converts it into the literal numeric value. In most coding tasks, there is almost always more than one way to do something.

Once we have those two single digits, we convert them into a three-digit value by multiplying the first by 100, the second by 10 and storing the result in integer variable `threeDigits`.

Why do this? Resistor values are set using a number sequence of 'preferred values' known as an E-series with E12 and E24 series the most common. E12 values are 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 – and they are multiplied by factors of 10 to get set values between 1.0-ohms and 10-megaohms. Bottom-line, E12 and E24 preferred values are always two-digits – that mean the third digit in commonly-found resistors is always zero. By multiplying the two-digit value by 10, we get the value of the first three.

Now to get that fourth 'multiplier' digit, if we divide the total resistor value by the value of the first three digits, we get the multiplier factor, but we really need the multiplier factor as a factor of 10 – in other words, the mathematical log to base-10. And we get that using Java's `Math.log10` function and store the result in the integer variable `multiplier`. Here's how it works – if we divide the resistor value (10000 in our example) by the first three digits (100), we get 100. The base-10 log of that is two (you just count the number of zeros). And from the code, we know two is red. If we were working with four-ring resistors,

```
1   package colourcode;
2
3   import java.util.Scanner;
4
5   public class ColourCode {
6
7       static String[] digitColour = {"black","brown","red","orange","yellow","green","blue","purple","grey","white"};
8
9       public static void main(String[] args) {
10
11          int ohms = 0;
12          System.out.println("--------------- E12 Resistor Colour Code Finder---------------");
13          System.out.print("Enter in the resistor value in ohms (between 10 and 10000000): ");
14          Scanner input = new Scanner(System.in);
15          ohms = input.nextInt();
16          System.out.println("Five-band colour code for "+ ohms + "-ohm E12 resistor @ 1% tolerance: " + getColour(ohms) );
17
18      }
19
20      static String getColour(int ohms) {
21          String code = "";
22          int digit1 = Integer.parseInt(Integer.toString(ohms).substring(0,1));
23          int digit2 = Character.getNumericValue(Integer.toString(ohms).charAt(1));
24          int twoDigits = digit1 * 10 + digit2;
25          int multiplier = (int)Math.log10(ohms/twoDigits) - 1;
26          code = "| " + digitColour[digit1] + " | " + digitColour[digit2] + " | black | " + digitColour[multiplier] + " | brown |";
27          return code;
28      }
29
30  }
31
```

colourcode.ColourCode > main >

```
Output - ColourCode (run)
run:
--------------- E12 Resistor Colour Code Finder---------------
Enter in the resistor value in ohms (between 10 and 10000000): 10000
Five-band colour code for 10000-ohm E12 resistor @ 1% tolerance: | brown | black | black | red | brown |
BUILD SUCCESSFUL (total time: 4 seconds)
```

Our resistor colour code app uses a String array and two methods.

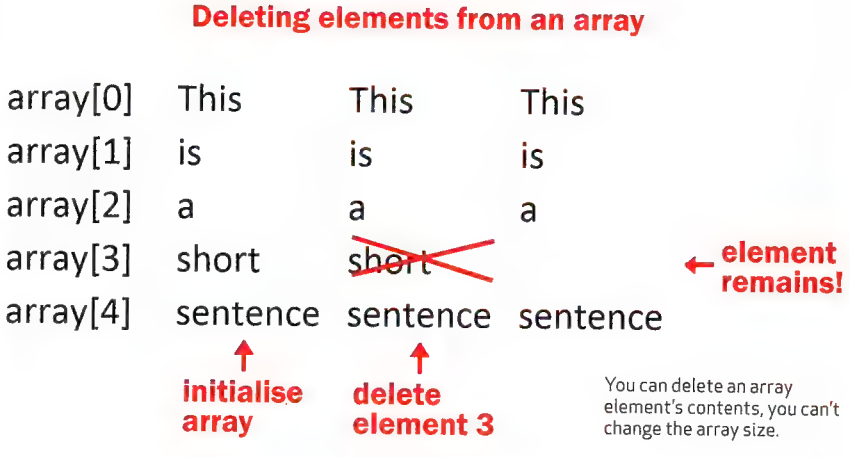
the final 'times-10' on that the codeline would be removed.

Finally, we now get to use the `digitColour` array. We use the `digit1` and `digit2` values as indexes to the array to recall the correct colours and likewise use the multiplier variable as index for the correct multiplier colour. These colours are written to a string called `code`, which is returned to the main method, the code string is printed to the screen and the app finishes.

VARIABLE ARRAYS — ARRAYLISTS

Arrays are brilliant if you know the size you need initially, but what if you don't? How do you change the size of an array in your code on-the-run or 'dynamically'? That's easy — you don't. Once an array is declared, its size is fixed — you cannot change it. If you want a variable-sized array, what you actually want is what's called an 'ArrayList'. Now we're getting dangerously close to some advanced topics such as object-oriented programming, collections and data structures, but even at this early stage it's worth just a brief toe-dipping into these waters.

An ArrayList is an extendable array of data 'objects'. Objects are a huge area we'll cover in a few months, but essentially in Java, you can create an array list of almost anything once you define what that something is. The difference between an array and an ArrayList is that with ArrayLists, you can add to them, you can delete and insert elements and have the other elements move up or shuffle down automatically as appropriate. One example of how you can use ArrayLists is when creating a list of customers — you can add new ones, insert or delete others. You can also search and sort ArrayLists, but that's for another time.



You can delete an array element's contents, you can't change the array size.

APP #2 — ARRAYLIST DEMO

Rather than leave you scratching your head over all of this, we've deliberately kept our second app this month nice and simple, so you get a feel for how ArrayLists work. We start by creating an ArrayList of strings called words. Prior to Java 7, this line would've needed to have been:

```
ArrayList<String> words = new ArrayList<String>();
```

```
Output - ColourCode (run) ×
run:
--------------- E12 Resistor Colour Code Finder---------------
Enter in the resistor value in ohms (between 10 and 10000000): 10000
Five-band colour code for 10000-ohm E12 resistor @ 1% tolerance: | brown | black | black | red | brown |
BUILD SUCCESSFUL (total time: 3 seconds)
```

Our colour code app tells you the colours for a particular resistor value.

But Java 7 brought in the shortcut we've used in our code:

```
ArrayList<String> words =
new ArrayList<>();
```

Next, we ask the user to type in a sentence, which is then stored in String variable `sentence`. We then take that variable and use a String class method called split, which allows you to split a string into an array of strings based on one or more delimiter characters. We can do this simply by using spaces as the delimiter so that we end up with a string array of `words` called `wordList1` with each word now an element in that array. This works well, but remember, now that we've created the array, we can't add to it, nor can we remove any element – we can delete an element's contents but not the element itself, so the elements following won't move up. So instead, we now take each element of the `wordList1` array and add it to the words ArrayList using the one-line addAll method. First, we convert the `wordList1` array into a list using the Arrays.asList function, then add each element to the `words` ArrayList via addAll.

Now that we have the sentence as an array list of strings, we can remove and insert at will. Next in our code, we delete/remove the second word in the list – remember, array/list indexes start from zero, so the second word is at index 1. We use the remove command to remove the element at index 1 and the rest automatically move up.

After that, we ask the user for a replacement word, store it in string variable newWord and use that word to plug back into word ArrayList at index 1. We do that with the add method again but this time, we include the index position we want the word to go into as an extra parameter and the name of the string referencing the word.

variables vs arrays

score1	10	score[0]	10
score2	23	score[1]	23
score3	34	score[2]	34
score4	88	score[3]	88
score5	123	score[4]	123
score6	211	score[5]	211
score7	0	score[6]	0
score8	4	score[7]	4
score9	24	score[8]	24
score10	55	score[9]	55
score11	61	score[10]	61
score12	100	score[11]	100
12 different variables		**one variable, 12 indexes**	

Arrays allow you to store multiple values in the one indexed variable.

Finally, we ask the user for a second sentence and using the 'add' method, again add in each word from the new sentence to the end of the `words` ArrayList.

BASIC KEYS TO USING ARRAYS

There are a few key things to remember when using arrays or ArrayLists – first is how to retrieve the size. You'll find this important to know in most apps, even in our demo here. To find the size of an array, you need the `array.length` function, but for an ArrayList, you need `ArrayList.size()` method. Something to remember.

Another key feature is whenever you access an array or ArrayList, the index must be within the array size/length, otherwise, you'll get a run-time error.

And finally, you'll notice that to obtain the value of a particular element of an array, you use `array[index]` whereas in an ArrayList, you use `ArrayList.get(index)`.

LOTS MORE

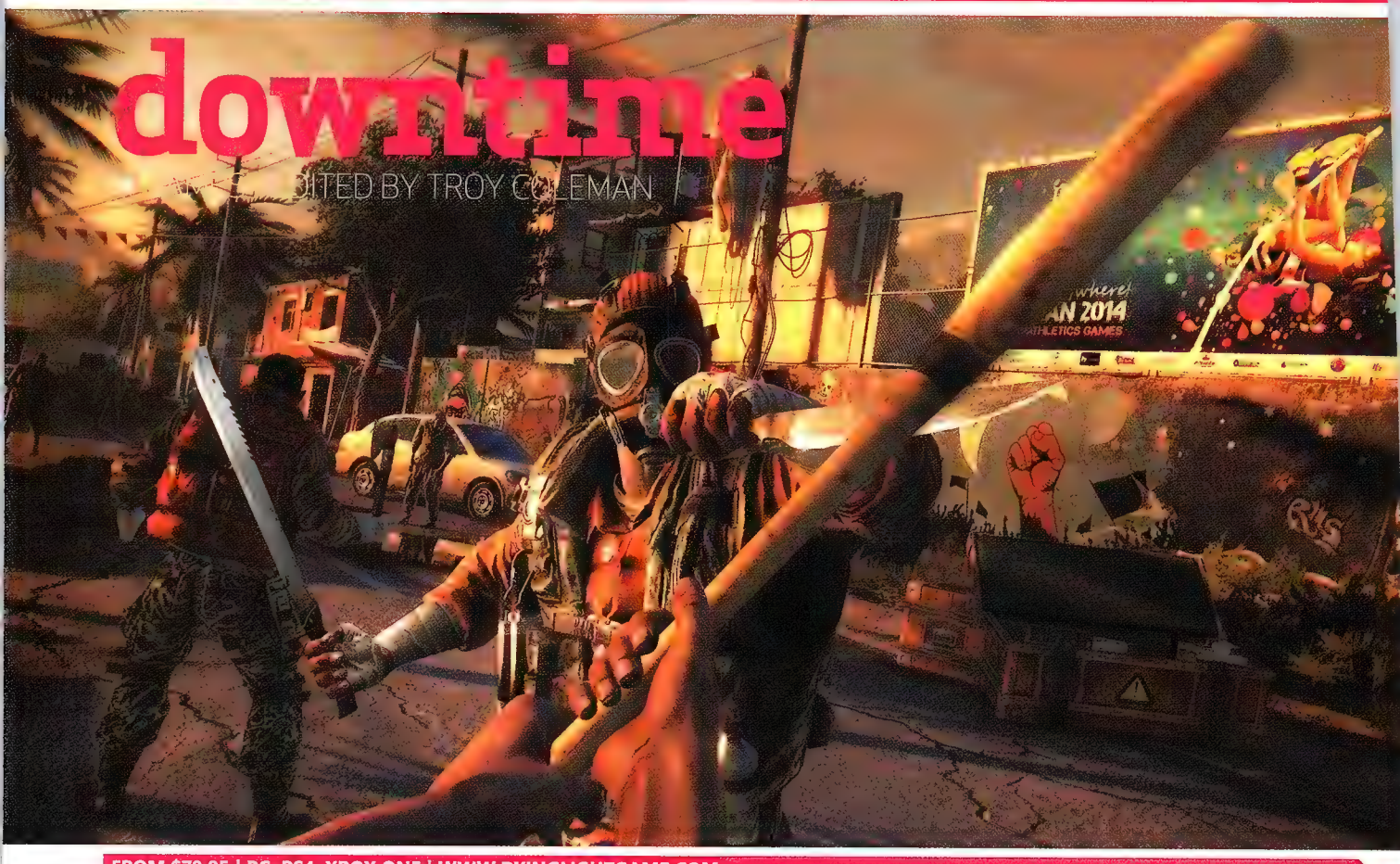
Lists are just one example of Java's data structure or 'collections'. Throw in stacks (simple list where last-in is first-out), queues (first-in is first-out) and sets (no duplicates are stored) and there are many ways you can manipulate data in Java.

NEXT TIME

The first six parts of this series have been all about filling your toolbox with the basic nuts and bolts of simple Java coding. Using the console to get input and display output has made that nice and easy. But starting next month, we crank things up a gear and begin looking at how to build Windows-like graphical user interface or GUI apps, with panels, buttons, radio buttons and all the rest. See you then. ■

downtime

EDITED BY TROY COLEMAN



FROM $79.95 | PC, PS4, XBOX ONE | WWW.DYINGLIGHTGAME.COM

Dying Light

Dead Island goes vertical.

Verdict

An ambitious and polished zombie evasion game let down by shoddy storytelling and repetitive missions.

★★★½☆

When the zombie apocalypse comes, you'll be out fetching chocolate bars for the man under the bridge. Or if not chocolate bars, every other bloody thing under the sun. *Dying Light* is an impressive open world sandbox with a beautifully fluid and challenging parkour system, but studio Techland seems at a loss for exciting things to do in it.

Despite the gruff protagonist working for some ostensibly important agency, he's basically just a courier. You'll be fetching things, turning on this or that generator, clearing out X number of zombies and giving nary a damn about the paper thin plot. These mediocre elements don't stop *Dying Light* from being fun, but they do ensure the game falls short of great. As a co-op and loot driven game, story isn't important when you've got friends around to bash zombies with, but as a single-player experience *Dying Light* can be lonely and unforgiving.

Unlike Techland's other zombie series, *Dead Island*, this game isn't all about assaulting zombies with deadly weapons. Traversing the Turkish-influenced city of Harran, with its multi-storey slums and towering freeway turnpikes, is the real meat and potatoes of the game and traversing gracefully is a lot more satisfying than watching a shambler cop it in the skull. Getting into a good flow is all about avoiding hordes of undead while chiselling a neat path through the haphazard skyline.

At least, that's what you'll do during the day. At night, *Dying Light* is a totally different experience. Death is a near certainty if you make too much noise, though moving around at night will usually reap you higher Agility and Survival points, which along with Power comprise the three progression tiers in the game. Story missions requiring night exploration are something you'll begin to dread, because the tension can become unbearable.

Still, that tension is somewhat alleviated with a friend or three, and besides: survival horror aficionados thrive on this kind of masochism. It's this strange dual tension – between *Dying Light's* aspirations as a hi-octane action game and a slow burning horror – which stands as its most interesting characteristic. Just proceed with caution if you intend to play alone though. This is a game designed from the ground up to be enjoyed with other uninfected. ■ **Shaun Prescott**

FROM US$19.95 | PC, X1, X360, PS3, PS4 | WWW.SAINTSROW.COM

Saints Row: Gat Out of Hell

Welcome to expansion pack purgatory.

We love *Saints Row IV*. It's funny, silly and surprisingly warm-hearted. It's important you know that. Because we don't love *Gat Out of Hell*. We don't hate it, by any means, but it seldom displays the spark of creativity that made the last two games so good.

In this standalone *Saints Row IV* expansion you play returning characters Johnny Gat and Kinzie Kensington on a mission to rescue 'The Boss' – the moldable agent of chaos at the centre of all previous games – from Satan. More specifically, from Satan's arranged marriage plans. This is all great. But it all takes place in a cutscene.

Gat Out of Hell's best moments are all in cutscenes, where the characters are free to break out of the rigidity of the game itself. Even worse, the best joke was released in its entirety as a trailer. It ruins what could have been a wonderful surprise.

The major problem with *Gat Out of Hell* is that the series' other traditional methods of delivering jokes – through its mission design and scripting – are almost entirely absent. Instead, the game's mission-givers offer playlists of open-world mini-game activities. *Saints Row IV* did this as a diversion between the main missions, but here, there are no missions. Your job is to complete activities until you've caused enough carnage to attract Satan's wrath. Do so, and you'll unlock the final boss fight. It took us around five hours, albeit with plenty of other activities left on the map.

HELL FLIER

With no missions, the entire game is reliant on its open-world design. Some of this is exceptional. Where in *Saints Row IV* you could super-jump and glide, in *Gat Out of Hell* you can fly. It's brilliant. Your job is to maintain momentum, and with practice you can reach some exhilarating speeds. It gives an entirely new sense of freedom, and makes collecting Clusters – collectible souls that upgrade your powers – a joy.

Aside from such notable exceptions, most of the activities, weapons and superpowers are lifted from the previous game. Some of the new weapons are fun. The exploding frog launcher was our constant companion throughout the game, and the armchair Gatling gun was funny enough to regularly make it into our rotation. *Saints Row's* combat has never been its strong suit, however. It's functional, but the system feels more suited to large-scale carnage and mayhem than it does to the moment-to-moment headshotting of demons. In *Gat Out of Hell*, the smaller scale stuff seems more prevalent, and the grand set-pieces sorely lacking.

There are only a handful of different activities, each repeated multiple times. Torment Fraud is essentially a reskin of *Saints Row IV's* Insurance Fraud, in which you throw yourself in front of cars and fight against an irritatingly imprecise ragdoll system. Survival and Mayhem also make the transition, and are similarly identical to previous versions. Of the new events, Hellblazer and Salvation make use of Gat's flight ability, and as such are the best.

Our disappointment comes with caveats. First, this is an expansion, and so of course will be smaller in scope than a full game. Second, it's priced like an expansion. That absolves *Gat Out of Hell* of a lot of its sins, but nevertheless leaves it feeling restrained and underwhelming. ■ **Phil Savage**

Verdict

Great new flying ability; open world as good as always; fun new weapons.

★★★½☆

Crossy Road

How many roads must a frog hop down?

US$12.95 | IOS, ANDROID
WWW.CROSSYROAD.COM

If *Frogger* was built in *Minecraft* and then force fed energy drinks it might spew out something like *Crossy Road*. In it you guide your avatar across bustling highways, as well as streams and rail tracks, with simple taps and swipes. Anyone that's been around for as long as we have (and that's a fair while) will know that *Frogger* remains a bastion of classic game design. But, much like the recent *Pac-Man DX* instalments modernised the old with dashes of contemporary, neon-lit dust, *Crossy Road* injects a little something extra into the formula alongside its almost offensively colourful style. As you move forward, the camera does too. Spend too long waiting for the perfect opportunity to jump and your character will cop it off the edge of the screen. This small tweak of the otherwise fairly rote recipe changes everything, ensuring that each time you're squished against the side of a passing truck or taste the metallic splat of a train in your face you'll still want to insta-tap the replay button as you attempt to bound past your pals' high scores. Less savoury is the borked coin system. Used to buy new, admittedly purely aesthetic, characters to control, in-game cash can be earned in tiny increments by actually playing. However if you force yourself to watch a few ads in between games you'll actually reap more currency, which makes us throw up a little in our mouths.

■ Matthew SG

$13.45 | PC, X1 | PRESSPLAY.DK/GAMES/KALIMBA

Kalimba

The odds are stacked against you.

It's not been a vintage 12 months for the Xbox One. It's not been terrible, but in wine terms this would probably be the kind of year that produces the sort of plonk you buy for dinner parties.

Illustrated entirely with triangles, in a style we've heard being called 'trixellated' by people who can't bear the thought of not having a portmanteau for everything, *Kalimba* grabs you by the eyeballs the second it's loaded. Shortly after, the introduction of Hoebear the Metabear – a vaguely grizzly geometric character – prefaces the game as one that's not afraid to poke fun at itself.

That wit and creativity courses through *Kalimba's* veins, from its premise – a mind-bending, dual-character puzzle-platformer with the hook that you control both cutesy totems simultaneously with a single input – to its surprising, giggle-inducing abilities that are introduced along the way. Clever design throughout the levels keeps the flow pacey, and though stages are fairly short, there's plenty packed into each. Early levels teach you the basics: stacking your two totem pieces on top of each other, double-jumps, and the very important lesson that you can only go through colour-coded lumps of triangle-lava that match one of your characters.

Tactical thinking and creative problem solving – combined with fairly slow progress as you try to work out the order in which you need to jump, switch and stack – will be your companions for the first few levels. Soon, your fingers will be dancing across the controller in a carefully choreographed ballet of button-pressing, and you'll be in search of a new challenge. As the difficulty curve is pretty well-matched to the progress of the game, you might not need such a hurdle straight away – but even after the main game is completed, there are still plenty of things to do.

The local co-op mode gives each player two pieces to control, unlocking new powers including quadruple jumps and the ability to scream a stream of expletives at your partner after the eighth time he bounced into the triangle lava. After that's done – and that's enough of a challenge in itself – you'll unlock a solo co-op mode: controlling four pieces with one controller, which is comparable to rubbing your tummy and patting your head while trying to learn the bagpipes and cook a soufflé. And then, of course, there's the leaderboards to take into consideration, because you can't let your boss be the high scorer, and if you haven't gone through every level without a single death, then you've pretty much brought shame upon your entire family.

It's a brilliant, lovely surprise to have such a polished and well-designed gem of a game for a console that's so far been more about triple-A than indie. Anyone with an Xbox One should have a go – it's well worth your time and well worth the price. And it's considerably better than a cheap chardonnay any day.

■ Kate Gray

Verdict

With excellent ideas throughout, *Kalimba* is a brilliant way to reinvigorate XO's indie credentials.

★★★★½

FROM US$19.95 | PC, X1, X360, PS3 | WWW.CAPCOM.CO.JP/BIOHD/EN

Resident Evil HD Remaster

Shinji Mikami's horror classic rises from the dead.

We're used to feeling like the centre of attention in games, like the whole world revolves around us. But *Resident Evil's* zombie-plagued mansion doesn't care about you. It's a place where death lurks around every pre-rendered corridor, and if you stumble into one of its sadistic traps or undead denizens, bad luck. It's back to the main menu with you, and you better hope you saved. *Resident Evil* doesn't hold your hand: it rips it off and eats it.

This is a remastered version of a 2002 remake – for the Nintendo GameCube – of the original 1996 game. It retains the fixed cameras, rendered backgrounds and tank controls of Mikami's pioneering survival horror, but mixes a few things up. If you know the Spencer mansion from the PlayStation game inside out, there are plenty of surprises. But if you've never played the original, this is the best place to start.

You can play as one of two characters, each with their strengths and weaknesses. There are no respawning items in the haunted house setting, so it becomes a game about management: knowing when to fight, when to run away and conserve ammo, and whether to use a health item now or save it.

Even your saves are finite. *Resident Evil* really is a survival horror game. Every wasted bullet or typewriter ribbon (which are used to save) could come back to haunt you later.

The remastering isn't as good as we'd hoped. We thought they might have dug the original pre-rendered backgrounds out of some dusty archive and presented them at a higher and previously unseen resolution, but it seems as if they've just added a filter to the existing GameCube files. As a result it doesn't look spectacular, especially on larger monitors, but the lighting and atmosphere make up for it. Light sources in the world illuminate your character as you move past them, which does a surprisingly good job of fooling your brain into thinking these are actually 3D spaces.

The mansion is a wonderfully eerie setting, and the fixed cameras, although archaic, actually add to the tension. The game uses blind corners to great effect, and you'll often hear the groan of a zombie before you see it. This makes you play cautiously as you creep through the dingy corridors. Sometimes the camera will be peering at you through a window or floating above you, which gives you an uneasy feeling of being watched. Rather than being hamstrung by their two-dimensional limitations, the developers have used them to make a really effective horror game.

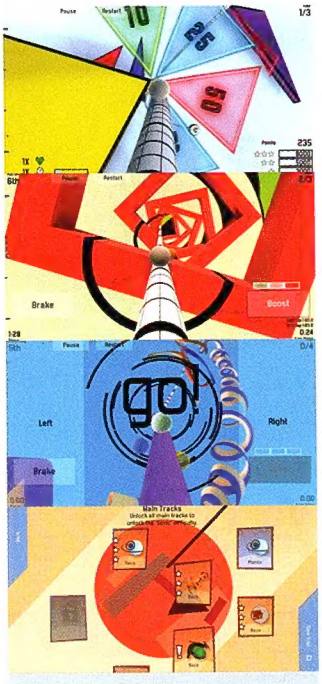
With hardcore survival games frequently topping the Steam charts, Capcom has picked a good time to revive *Resident Evil*. It's a punishing, but immensely satisfying game, even if the 'remaster' isn't as dramatic as the title suggests.

■ Andy Kelly

Verdict

Remastering is visually underwhelming; keyboard and mouse controls aren't the best.

★★★★☆



Proun+

A journey through modern art

$3.99 | IOS
ENGINE-SOFTWARE.COM

Inspired by the art of Mondrian and Kandinsky, *Proun+* is like a breakneck dash through the synapses of a painter's brain. It is an explosion of colour as you wrestle a ball along tube-like rollercoasters covered in colourful barriers that stop you dead. Spin around the tube, avoid obstacles and finish in the top three to unlock a new track or challenge. Open up all of a level's tracks and you can do it all over again — only faster. *Proun+* can be dizzying, and it can frustrate until you understand a track's layout, or if you get stuck on a survival race (one hit and it's game over). But tracks with point gates and races against five other balls are fun. You can't collide with them, but they can hit obstacles, which they do — often. It's great to feel the game even has it in for your opponents as you shoot along in a vibrant and imaginative world.

■ Craig Grannell

"The Intel MICA is targeted exclusively at women, featuring an 18K gold coating and curved sapphire touchscreen display."

A wearable designed 'exclusively' for women...

An expensive bracelet fulfilling an extremely limited purpose.

Described as a product where 'beauty meets intelligence', Intel's developed the world's first 'luxury smart bracelet' (even if it wasn't necessarily needed in the first place). The Intel MICA (short for My Intelligent Communication Accessory) is targeted exclusively at women, featuring an 18K gold coating and curved sapphire touchscreen display. Unlike other smart devices, the bracelet is designed to work independently of a smartphone. Rather, it features its own SIM card, with the wearer able to receive and reply (from a range of canned responses) to text messages sent to the device — handy if you don't already own a smartphone... or a pager. Costing just under US$500, the bracelet will come with a 2-year data contract and is currently being sold exclusively in the US — and to be honest, this is one gadget that can stay there... **TB**

ELDERS REACT FACT
Some of the controversy comes from sexual situations and nudity. In Grand Theft Auto: San Andreas, there is a downloadable "minigame" where a character is shown having sex and the player can control the character during the "game." GTA IV's "The Lost and Damned" expansion pack included a full frontal male nudity scene.

GRAND THEFT AUTO — RETRO EDITION

ELDERLY GAMERS GONE WILD?

While YouTube continues to be the go-to platform for cat videos, a new series of clips have emerged showing the views and reactions of the elderly as they play the extremely violent and controversial *Grand Theft Auto V*. In one video (**tinyurl.com/kqj2p57**), the older generation are presented with the game's highly explicit trailer, with responses ranging from how the game is "so real looking" and "edgy", to one man dissing it entirely, describing himself as more of a "Halo guy". The makers of the videos also asked subjects questions on a range of topics, with candid responses often revealing personal details, such as one older woman who claimed that she's "always had a secret desire for the darker side." **TB**

The apocalypse is coming!

#FacebookDown = #TheWorldIsEnding

The title to this story really says it all... or at least what many social-media addicts were saying on Twitter when Facebook, Instagram and Tinder all went down across the globe on January 28, 2015. At approximately 5:15pm AEST, witnesses to the event reported seeing hundreds of young people walking up and down the streets, pushing people left and right, asking them to 'like' them, begging them to become their friend. Those not out in public were glued to TV screens, as news outlets reported minute-by-minute details of the crisis, with many forecasting a baby boom in exactly nine months. Thankfully, after an agonising hour of downtime, these essential services were finally restored — and a collective sigh of relief was breathed by society as a whole.

Abbott's LOL

Prime Minister Abbott has done the unthinkable... and dissed social media! Rather than supporting the platforms, which are increasingly embraced by Australians of all ages, Mr Abbott dismissed complaints about his government's controversial knighting of Prince Philip that came from sites such as Twitter and Facebook. He described the complaints as 'electronic graffiti', with 'as much authority and credibility [as what's] sprayed up on the walls of buildings'. And yet, that'd seem to contradict the millions of dollars the government spends on market research and media monitoring, which increasingly includes information on social media. It's therefore no surprise that many 'electronic graffiti artists' were quick to respond, with the #electronicgraffiti hashtag becoming popular soon after the comments were made. ■

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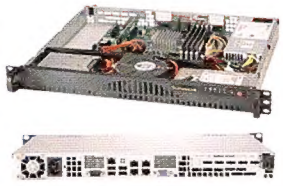

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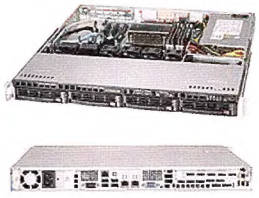

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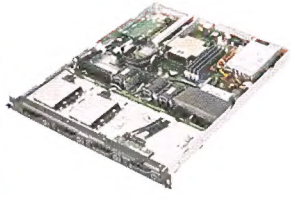
- 4x DDR3L 1333/1600MHz ECC UDIMM slots
- 12x 3.5" or 2.5" SATA fixed HDD/SSD bays
- 1x PCIe G3 x8 slot (x 8 signals) Slot
- 1x Intel® 82599ES 10Gb SFP+; 4x Intel® 82574L GbE RJ45
- 1x fixed 80plus gold-level 400W Power Supply

DreamMicro Power Server 1U S100-X1S1N From $1,149 RRP

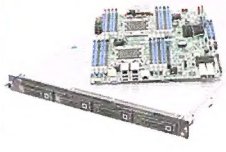
Intel Xeon 4th Generation | 4x HOT SWAP Drive Bays | IPMI 2.0 with KVM over LAN



- 1x Intel® Xeon® E3-1200 v3 4th Generation Processor
- 4x DDR3L 1333/1600MHz ECC UDIMM slots
- 4x 3.5" or 2.5" hot-plug HDD/SSD bays + 2x fixed 2.5" bays
- 2x PCIe G3 x8 mezzanine slots (x 8 signals)
- 2x Intel® I210 GbE RJ45 ports
- High efficiency 400W Power Supply 80 Plus Gold

DreamMicro Power Server 1U D51PS-1U From $2,499 RRP

Intel Xeon E5-2600/v3 | 4x HOT SWAP Drive Bays | IPMI 2.0 with KVM over LAN



- 2x Intel® Xeon® Processor E5-2600 v3
- 16x DDR4, Up to 2133MHz RDIMM/LRDIMM
- 10x 2.5" or 4x 3.5" Hot-plug HDDs
- 1x PCIe x16 G3 slot for low-profile card or mezzanine
- Intel® I350 1GbE RJ45 ports
- 1+1 High efficiency redundant hot-plug Power Supply

DreamMicro Power Server 2U 5028R-WRF From $2,099 RRP

Intel Xeon E5-2600/1600v3 | 8x HOT SWAP Drive Bays | IPMI 2.0 with KVM over LAN

- 1x Intel® Xeon® Processor E5-2600/1600 v3
- Up to 512GB ECC DDR4, Up to 2133MHz; 8x DIMM slots
- 8x 3.5" Hot-swap HDD bays
- 4x Full-height x8 & 1x Low-profile x8 slots
- Integrated IPMI 2.0 and KVM with Dedicated LAN
- 500W Redundant Power Supplies Platinum Level (94%+)

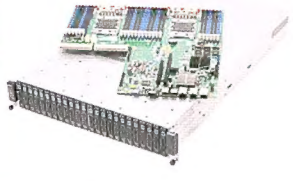
DreamMicro Power Server 2U 6028R-WRF From $2,599 RRP

Intel Xeon E5-2600/v3 | 8x HOT SWAP Drive Bays | IPMI 2.0 with KVM over LAN

- 2x Intel® Xeon® Processor E5-2600 v3
- Up to 1TB ECC DDR4, Up to 2133MHz; 16x DIMM slots
- 8x Hot-swap 3.5" SAS/SATA HDD bays
- 4x PCI-E 3.0 x8 (2 full and two half length) slots
- Intel® i350 Dual port Gigabit Ethernet Controller
- 740W Redundant Power Supplies Platinum Level (94%+)

DreamMicro Power Server 2U D51B-2U From $3,799 RRP

Intel Xeon E5-2600/v3 | 12x HOT SWAP Drive Bays | IPMI 2.0 with KVM over LAN



- 2x Intel® Xeon® processor E5-2600 v3
- 24x DDR4, Up to 2133MHz RDIMM/LRDIMM
- 24x 2.5" or 12x 3.5" Hot-plug HDDs
- 4x PCIe x8 G3, 1x PCIe x4 G3 low-profile + more
- Intel® I350 GbE RJ45 OR Intel® X540 10GbE Base-T RJ45
- 1+1 High efficiency redundant hot-plug Power Supply

DreamMicro Power Workstation 7048A-T From $1,999 RRP

Intel Xeon E5-2600/v3 | 8x HOT SWAP Drive Bays | 4U Rack Mountable

- 2x Intel® Xeon® Processor E5-2600 v3
- Up to 512MB ECC DDR4, Up to 2133MHz; 16x DIMM slots
- 8x Hot Swap 3.5" SAS/SATA HDD bays
- 3x (x16), 2x (x8), 1x (x4) PCI-E 3.0 expansion slots
- Intel® I210 Dual port Gigabit Ethernet Controller
- 1200W High efficiency Power Supply w/ PMBus

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